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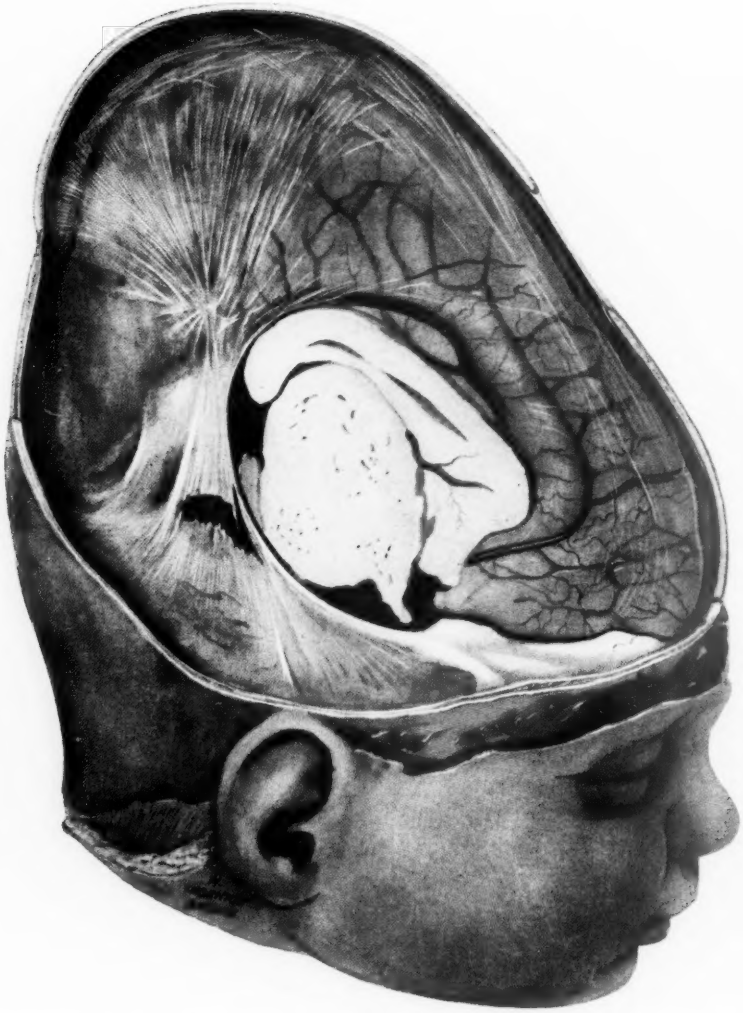

Fig. 1.—(Case 78.) Incomplete tear of tentorium cerebelli on right side; the tear is across the fibers at the base of the anterior vertical band. The head shows extreme molding after labor with generally contracted pelvis. Note elevation of apex of tentorium and change in direction of vein of Galen and straight sinus. (From Eden and Holland: Midwifery.)

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Original Communications

BIRTH INJURY IN RELATION TO LABOR*

EARDLEY HOLLAND, M.D., F.R.C.S. (ENG.), LONDON, ENGLAND

THE VULNERABILITY OF THE FETUS TO BIRTH INJURY

THE human fetus is peculiarly liable to injury during birth. Even at the term of pregnancy it is relatively immature and runs far greater risks than the more robust young of other mammals. None of its tissues —bones, epiphyses, muscles, viscera, or blood vessels—are well adapted to withstand the application of force; and, above all, its thin, plastic and incompletely closed cranium gives very poor protection.

Even under the best possible birth conditions injuries are liable to occur. The conditions, however, are by no means always favorable, and it is believed that they are in some respects becoming less so. Nowadays there are factors, increasingly common, which may act prejudicially; such, for example, as elderly primiparity, the demand for shorter and more comfortable labors, the over-use of anesthetic and oxytocic drugs, and the abuse of the obstetric forceps and labor induction. The wonder surely is not how many babies are injured but how many are born intact.

As regards causation one may make the general statement that the problem is a mechanical one, a consideration of the stresses of labor and the varieties of strain they may produce on the body of the fetus. Besides the immediate mechanical factor, two important predisposing factors must be emphasized, prematurity and asphyxia. The increased liability of the premature fetus is obvious. The effect of asphyxia will

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be discussed more fully under intracranial injuries; here it will merely be pointed out that an engorged vessel will rupture more easily and will bleed more.

A list of injuries would include almost every organ and tissue of the body; some are mortal, some merely crippling, but the vast majority are without any effect, immediate or remote. Philip Schwartz states that some traumatic effect of labor on the brain can be demonstrated in 90 per cent of all newborn and young infants coming to autopsy, and Ehrenfest's proposal that we must distinguish between "physiologic" and "pathologic" trauma is most illuminating in this respect.

THE EFFECT OF BIRTH INJURY ON INFANT LIFE AND HEALTH

To appreciate the scope of our problem we must study its effects in three directions: namely (1) stillbirth, (2) infant mortality in the early weeks of life, and (3) natal morbidity, i.e., permanent mental or physical crippling. We have two sources of information, national statistics as published by Departments of Health, and the results of special investigation into large series of cases. National statistics do not help much as regards the effect of birth injuries on the stillbirth rate. They merely state the rate. In England and Wales the registration of stillbirths did not become operative until the year 1928, since when the annual rate has averaged about 40 per 1,000 live births. No attempt is made to classify them into cases of antenatal and cases of intranatal death (i.e., into macerated and fresh fetuses), or to demand the cause of death, in the certificates. Indeed this would be impossible; for every case would require at least an expert autopsy. However, we can get a rough idea of the toll which birth injury takes on infant life from the results of investigations into large series of cases; most workers agree that about one-half of all cases of intranatal death reveal evidence of birth injury.

As regards infant mortality national statistics give valuable information. They reveal that, although the infant mortality for the first year of life has fallen in a remarkable manner during the last twenty-five years, there has been relatively little fall during the early days of life. We, as obstetricians, can claim hardly any share in this triumph of preventive medicine. The causes of death during the first four weeks of life are preponderatingly obstetric, namely, birth injury, prematurity, and septic infections, each accounting roughly for about one-third of the deaths.

Table I shows the age distribution of infant mortality rates between 1906 and 1930 in England and Wales. The figures reveal that when the two quinquennia 1906 to 1910 and 1926 to 1930 are compared, (a) the deaths under one year fell by 42 per cent, (b) the deaths under four weeks fell by only 20 per cent, and (c) the deaths under one week fell by the comparatively small figure of 9 per cent.

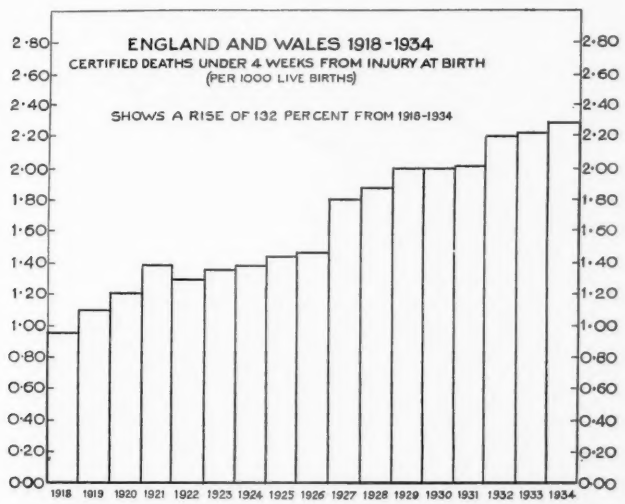
TABLE I. AGE DISTRIBUTION OF INFANT MORTALITY, 1906-1930, IN ENGLAND AND WALES (RATES PER 1,000 LIVE BIRTHS)

YEARS	DEATHS			
	UNDER ONE DAY	UNDER ONE WEEK	UNDER FOUR WEEKS	UNDER ONE YEAR
1906-1910	11.5	24.5	40.2	117
1911-1915	11.4	24.1	39.0	109
1916-1920	11.0	23.4	37.0	91
1921-1925	10.4	21.7	33.4	75
1926-1930	10.3	21.8	31.8	68

IS THE DEATH RATE FROM BIRTH INJURIES RISING?

If we misread our national statistics, we may be led to believe that deaths from birth injuries are increasing in number and to draw false inferences therefrom.

TABLE II



L. K. Frankel, a vice-president of the Metropolitan Life Insurance Company, New York, dealing in 1927 with the infant mortality figures in the United States registration area, drew attention to what he called "the startling fact" of the sharp increase in the death rate from birth injuries, and inferred that it was due to the increased use of instruments to hasten delivery. If we examine the figures for England and Wales, as shown in Table II, we see a progressive rise from 0.98 per 1,000 in 1918 to 2.27 per 1,000 in 1934, an increase of 132 per cent. Are we therefore justified in asserting that the number of deaths from birth injury has increased in this remarkable manner? By no means. All we can infer is that the number of deaths *certified by doctors* as due to birth injury has increased. During the last twenty years knowledge about birth injuries and their diagnosis has become widely diffused, and

death certification in this respect must have vastly improved. The injuries are not more in the heads of the babies, but more in the minds of the doctors.

THE VARIETIES OF BIRTH INJURY

A complete list of injuries would have to include every tissue and organ in the body, and I do not propose to make one. Intracranial injuries are the commonest and they present the most important problems as regards production, prevention, diagnosis, and treatment. My classification will therefore be a simple one: I. Other injuries, and II. intracranial injuries.

I. INJURIES OTHER THAN INTRACRANIAL

A brief mention of the most important must suffice: (1) skin and subcutaneous tissues anywhere, but chiefly the scalp, (2) muscles (sternomastoid), (3) fractures of bones: skull, clavicle, humerus, and femur, in order of frequency, (4) separation of epiphyses, (5) rupture of, or hemorrhage into abdominal viscera (liver, suprarenal), (6) damage to thoracic viscera (rare), (7) peripheral nerve injuries (facial, brachial), (8) the eye, direct injury or hemorrhage, (9) injuries to spinal cord and vertebral column.

Damage to the spinal cord is a commoner cause of fetal and neonatal death than is generally supposed and may occur during the forcible extraction of the aftercoming head or of large shoulders in head presentation. It is often overlooked at autopsy. Rupture of the liver is a not uncommon mortal injury inflicted during difficult breech delivery and is due to clutching the fetus by the abdomen.

II. INTRACRANIAL INJURIES

Considering the peculiar liability of the head to injury, it seems on first thought strange that it should act as the battering-ram by which the fetus forces its way into the world. Nevertheless, when the head comes first it is far less liable to injury than when it comes last. It is apparent that the inherent disabilities of the head, considered as a body exposed to stress, are to a certain extent compensated by certain protective properties. Its plasticity enables it to undergo changes in shape which adapt it to the changing shape and direction of the birth canal; its elasticity enables it to regain its shape in the intervals of stress, and so to place the intracranial contents again in a state of rest; its capacity, to a certain extent, to expand allows it to gain a little respite from the swelling of intracranial congestion and edema; and the arrangement of dural septa acts as stays or ligaments, which tend to restrain a dangerous degree of distortion.

In practical obstetrics the study of the head as a birth object is of great interest and importance, for the obstetrician who understands the mechanical problems involved will injure fewer heads than he who

does not. During its passage the head is in a state of compound compressive stress, the resultant between the powers of labor and the resistance of the maternal passages. This stress may be roughly regarded as consisting of two elements: (1) a general compression of the whole head, (2) a simple longitudinal compression by opposite forces acting at the ends of the diameters of engagement, i.e., the diameters lying between the occiput and the forehead, and the biparietal diameter, in vertex and breech presentations. For practical purposes it may be said that the stresses and their effects vary chiefly with (1) the absolute amount of the forces acting on the head at any given time, (2) the direction in which these forces act on different parts of the head, (3) the degree of plasticity of the head, (4) whether the forces attain their maximum effect suddenly or gradually, and (5) the length of time they act.

Cranial stress may be normal or excessive. The effect of stress is strain (strains being analyzable into stretches and slides or shearing strains). Normal stress leaves no observable effect on the head or only a moderate amount of molding. Excessive stress may result in (1) excessive alteration in the shape of the head (an example of shearing strain), (2) overstretching and tearing of the dura mater septa and rupture of certain blood vessels, (3) a rise in intracranial pressure sufficient to obstruct the venous sinuses and cerebral veins and to produce cerebral congestion and edema.

The following intracranial injuries may occur:

A. Injuries to the dura mater septa (tearing of the tentorium cerebelli and falx cerebri), nearly always accompanied by one or more of the varieties of hemorrhage under Group B.

B. Injuries to blood vessels, resulting in (1) subdural hemorrhage, usually gross, from cerebral veins and dural sinuses, and associated with tearing of the dural septa, (2) meningeal capillary oozing, usually of asphyxial origin, (3) ventricular hemorrhage, from choroid plexus, (4) intracerebral hemorrhage.

C. Other effects of cerebral compression: congestion and edema of brain and meninges with increased intracranial pressure, leading to asphyxia of the brain and medullary centers.

A. *Overstretching and Tearing of the Dural Septa.*—Alterations in the tension of the septa accompany alterations in the shape of the head. This is inevitable from the nature of the attachment of the septa to the cranial bones, as can be demonstrated on a fetal head by reflecting the scalp and removing sufficient of one parietal bone to allow the cerebral hemisphere to be removed and the septa to be viewed from that side (Fig. 1, frontispiece). On compressing the head in the suboccipitobregmatic diameter, the head becomes shortened anteroposteriorly by forward displacement of the occipital bone and heightened vertically by bending and elevation of the vault (Fig. 1). If at the same time the septa are observed, the middle two-thirds of the falx cerebri and the tentorium will be noticed to become stretched and tense. Moreover, the septa move as a whole, as will be appreciated by observing the anterior point of junction between the falx and tentorium (the site of entrance of the vein of Galen into the straight sinus) which becomes displaced upward and forward, the forward movement being much the more pronounced. If now by stronger compression the tension is increased, the tentorium tears near its free border just below its junction with the falx (Fig. 1).

It is seen that bending of the bones and excursion of the vault is resisted by the septa and when the septa tear a restraining influence is removed. The septa may be regarded as exerting a protective function in labor, forming a defensive system against excessive alteration in the shape of the head. Reasonable molding of the head is beneficial; but undue distortion may jeopardize the life of the fetus by producing intracranial disturbances, the most important of which is hemorrhage from the overstretching and rupture of certain blood vessels.

The view that the septa are designed to take stress is supported by the fact that they contain strengthening bands and fibers arranged on admirable mechanical principles along the lines where stress is most likely to fall. These bands are, in my opinion, developed in order to enable the cranium and its contents to withstand the effects of excessive stress during labor. An anteroposterior and a vertical

Fig. 2.—Semidiagrammatic drawing to show arrangement of fibers in falx and in superficial layer of tentorium, after removal of parietal and part of occipital and frontal bones. *A*, points to black dotted line indicating floor of straight sinus; *B*, points to white dotted line indicating position of deep horizontal band; *C*, points to anterior vertical band.

system may be described. It is to the latter (Fig. 2) that I wish particularly to draw attention, for it is a beautiful example of the mechanical system of stress-lines. It consists of two opposing sets of convergent fibers which meet in their points of convergence. From above downward converge fibers from the middle two-thirds of the falx, and from below upward converge fibers from the tentorium. They meet in a strong band which I call the anterior vertical band of the tentorium. This band is subjected to stress in almost every labor and is the usual site of tentorial tears.

Tears of the tentorium and falx, as found in dead fetuses, support this theory of cranial stress. Tentorial tears are nearly always situated in what has been

described as the area of greatest stress, just below the junction with the falx anteriorly (and implicating the anterior vertical band). Tears of the falx cerebri are found relatively infrequently; they usually occupy the middle two-thirds and are elliptical, with the long axis of the ellipse lying, as would be expected, in the line of greatest stress (Fig. 3). The tears may affect one or both sides of the tentorium and may be complete or incomplete. Incomplete tears involve only the superficial layer. Complete tears usually involve the free border of the tentorium, but sometimes the free border is left intact and the tear appears as a perforation. Very commonly a small hematoma is found in the region of the tentorium which commonly tears; this is probably an effect of excessive stretching without tearing. Tears of the dural septa are not in themselves to be regarded as fatal injuries;

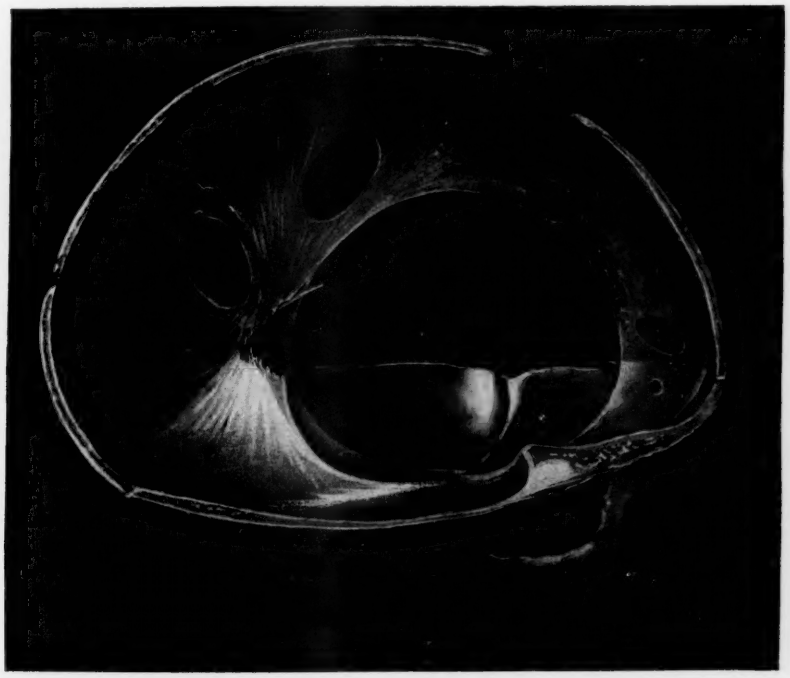


Fig. 3.—Complete tear of tentorium cerebelli, elliptical tears of falx cerebri. The tear is in the right side of the tentorium. The anterior one-third of the line of junction between the tentorium and falx has been torn through. The straight sinus (indicated by bristle) has been opened.

they bleed very little and sometimes not at all. They are the expression of excessive intracranial stress, the mortal lesion being the accompanying intracranial effects, namely cerebral hemorrhage and the asphyxial effects of intracranial pressure.

B. *Injuries to Blood Vessels.*—Etiologically there are two varieties of intracranial hemorrhage, traumatic and asphyxial. Gross hemorrhage is probably always traumatic; it occupies the subdural space and is nearly always found associated with tears of the dural septa. But asphyxial venous engorgement is a most important contributory factor in traumatic hemorrhage, for engorged veins rupture more easily and bleed more freely. Clear postmortem evidence of fetal asphyxia is usually found in cases of gross hemorrhage. A clear differentiation between traumatic and asphyxial bleedings is not always possible, and they often occur together. Engorge-

ment of the cerebral veins may be part of a general asphyxia, or may be a local affair due to obstruction of the cerebral veins from cerebral compression (''traumatic cerebral asphyxia''—see below).

Only when large vessels have ruptured is it possible to track down the hemorrhage to its source. Large veins commonly found ruptured are the vein of Galen and the cerebral veins entering the superior longitudinal sinus. Sometimes the venous sinuses themselves are opened; most commonly, as would be expected, the straight sinus, more rarely the superior longitudinal and lateral sinuses. I was able to detect rupture of the vein of Galen in only two of my cases; but A. C. Palmer, whose observations in a series of cases of cerebral hemorrhage were exceptionally complete and careful, found evidence of rupture of this vein in eight out of nine cases of subdural hemorrhage with laceration of the tentorium and falx cerebri. Reference to Fig. 1 shows the mechanism by which this important vein or its tributaries are ruptured. Any movement of the apex of the tentorium is necessarily transmitted to the vein of Galen whose upper fixed point is at its entrance into the straight sinus. It has already been pointed out that in the common form of head distortion the apex of the tentorium is drawn upward and forward. The vein follows this displacement with the result that it is stretched and has its line of direction so altered that it gets kinked and obstructed at its entrance into the sinus. Great engorgement of the vein is a striking appearance in most cases of intracranial injury.

The site as well as the size of a hemorrhage is of importance as regards its effect; large hemorrhages kill by cerebral compression and damage to the respiratory centers; hemorrhage in the posterior fossa (infratentorial hemorrhage) is more damaging than elsewhere in the subdural space.

C. *Hemorrhages in the Brain Substance.*—The concentration of interest on septal and vascular injuries led workers to overlook pathology of the brain itself. But in 1924 P. Schwartz began to publish work of outstanding importance. He removed the brain intact, studied it histologically and found petechial hemorrhages and small areas of necrosis in a remarkably high proportion of newborn children. The hemorrhages were definitely related to the distribution of the tributaries of the vein of Galen (vena terminalis, vena lateralis ventriculi, vena choroidea), and the necrotic areas appeared as opaque yellowish spots, often in confluent groups, in the central white matter and basal ganglia around the third and lateral ventricles. Schwartz makes the remarkable pronouncement that micro- or macroscopic hemorrhages or their sequels can be found in the brains of approximately 95 per cent of infants dying in the early weeks of life. He failed to find any of these appearances in the brains of a control series of brains of newborn animals with thick cranial bones and no fontanels, and points out the lack of protection afforded by the peculiarly thin and plastic cranium of the human fetus.

Schwartz's work has given rise to a good deal of controversy. Cruickshank points out the technical difficulties which arise in the preparation of the brains of the newborn for histologic examination; the soft and watery brain tissues are easily damaged during removal, undergo rapid autolyses, and shrink badly during fixation and embedding. A case reported by Kirkwood and Myers shows the importance of making a complete examination of the brain. After an easy normal labor an infant developed attacks of apnea and cyanosis and died twelve hours after birth. At autopsy no macroscopic intracranial damage was found, but serial sections through the brain stem revealed small hemorrhages in the lower part of the pons.

D. *Other Effects of Cranial Compression.*—Prolonged cranial compression may obstruct the venous sinuses and cerebral veins and produce asphyxia of the brain and medulla. The autopsy lesions are intense congestion and edema of the brain and meninges, and this still further increases the intracranial pressure. This condition is sometimes classed under ''intracranial lesions without hemorrhage,'' but I prefer to call it ''traumatic cerebral asphyxia.'' The effect of asphyxia of the

respiratory center would be to stimulate it, and the fetus would make intrauterine respiratory efforts, the presence of amniotic fluid in the trachea or bronchi in some cases of stillbirth being evidence of such efforts. The alteration in the intrathoracic pressure as the result of the inspiratory efforts would lead to venous obstruction in the heart and great vessels and an intense engorgement of the whole venous system, i.e., to the phenomena of generalized asphyxia. Such asphyxia would not necessarily be fatal; if prolonged it would lead to increasing paralysis of the respiratory center, causing the center to fail to respond to stimuli following delivery. Cruickshank lays special emphasis on increased intracranial pressure as a factor of the first importance in the production of a large proportion of cases of neonatal death.

STILLBIRTH: RELATION OF THE TYPE OF LABOR TO INTRACRANIAL INJURIES

In presenting this aspect of the subject I shall use my own original material, the results from which show no essential differences from those obtained by other workers. The main issue is, in what sort of cases is intracranial injury especially liable to occur, taking injury of the dural septa as the chief criterion?

There were 167 fresh fetuses (consecutive cases of intranatal fetal death) and tentorial tears were found in 48 per cent. There were 46 cases of head presentation, and 35 cases of breech presentation. The preponderance of breech presentations is remarkable, and shows the great liability to intracranial injury in breech labor.

Of the head presentations 44 were vertex, and one is at once struck by the high proportion of cases in which the forceps was used, 25 out of the 44 cases. Doubtless a certain number of the forceps extractions were for "disproportion" but all were "low forceps" except five. The occurrence of tentorial tears after a low forceps operation invites criticism. The use of the forceps is one of the central problems connected with the production of intracranial injury, as well as with its prophylaxis, as will be discussed later.

Another point which attracts notice is that the injuries occurred in a certain number of cases of spontaneous delivery. For some of these there was a sufficient explanation; in 37 per cent the fetus was premature and other factors were precipitate labor, the use of pituitrin and a former extensive perineal plastic operation. Nevertheless there remain a few cases in which labor was apparently in all respects normal. We should not allow these few to perturb us too much; they are rare, and it may be wiser to accept them as a natural hazard of labor, especially a first labor, rather than attempt to prevent them by a wide use of the "prophylactic forceps operation."

There were 47 cases of breech labor and tentorial tears were found in no less than 75 per cent. When the breech cases are divided into the three classes of normal breech labor (i.e., cases with no complication other than those natural to breech labor—extended arms and legs), complicated breech labor (e.g., with contracted pelvis, placenta previa), and breech by version, we see that tears were found in 88 per cent of

the cases of normal breech labor and 71 per cent of the fetuses delivered by version and extraction. Five of the normal breech babies were premature. These findings are common knowledge to us, but they are by no means yet common knowledge to the general body of doctors attending women in childbirth. They were not widely known even among obstetric experts twenty years ago, and I shall not forget the great joy that the almost constant discovery of these injuries gave me, for I felt that the mortality from breech labor could be reduced remarkably. The traditional teaching was that the great danger came when the child was so far born that the cord was compressed, and that the rest of the delivery must be hastened in order to save death from asphyxia. In consequence, it was the custom to hasten the delivery of the head and get it out within a few seconds of the birth of the trunk. The head was thereby subjected to a rapid compression in the suboccipitofrontal diameters, by being dragged forcibly through a vaginal orifice and past a perineum which were unprepared for its passage. We know now that far more breech babies are killed by head compression than by cord compression, and practice has been modified accordingly.

We may generalize as follows: Dangerous cranial stress and the resulting injury are especially liable to occur in (1) breech labor, (2) forceps delivery, (3) premature labor, (4) too rapid delivery (i.e., precipitate labor, use of oxytocic drugs), (5) states in which the cerebral vessels are congested, i.e., impending or early fetal asphyxia, clinically called "fetal distress."

PROPHYLAXIS

I begin by telling my students that they cannot expect to become good obstetricians unless they perform or assist in performing autopsies on cases of stillbirth or neonatal death; for that is the only way to learn how fragile the fetal tissues are, and how easily injuries, especially intracranial injuries, occur. I then utter the platitude that a large proportion of injuries are avoidable by good and sound obstetric practice, and the moral by showing Table III.

TABLE III. CORRELATION OF MATERNAL, FETAL, AND NEONATAL MORTALITY RATES IN ENGLAND AND WALES, 1930-1934

AREA	MATERNAL DEATHS PER 1,000 LIVE BIRTHS	STILL-BIRTHS PER 1,000 TOTAL BIRTHS	INFANT DEATHS PER 1,000 LIVE BIRTHS		
			UNDER 1 DAY	UNDER 1 WEEK	UNDER 4 WEEKS
England and Wales	4.4	41	11	22	32
County of London	3.3	32	10	18	25
Buckinghamshire	4.0	31	10	19	26
West Ham	2.6	33	9	18	25
Wales	6.1	55	12	26	37
Halifax	8.0	50	12	29	42
Oldham	7.5	55	13	29	42
Glamorganshire	6.3	58	13	27	41
Merthyr Tidfil	5.8	69	11	27	40

In Great Britain there are certain areas (towns, counties, boroughs, etc.) known as "black areas" because of their high maternal mortality rate. Recently an investigation (Oxley, Phillips and Young) into the maternal deaths during the years 1929 to 1931 in one of these areas was published, an industrial town with a maternal mortality rate of 10 per 1,000. All circumstances were passed under review: social conditions, doctors, midwives, hospitals, and it came out clearly that the high death rate was due to too frequent intervention in the course of labor by the doctors. In Table III is shown the correlation of maternal fetal and neonatal mortality rates in certain areas (some "black" and some "white," for contrast) in England and Wales for the years 1930 to 1934. It is clear that a low maternal rate goes with a low stillbirth and neonatal rate, and vice versa. The inference is clear. That which caused the maternal deaths caused also the fetal and infant deaths, namely, too frequent intervention in the course of labor.

Coming now to specific points in prophylaxis, certain things stand out for consideration, bearing in mind that although the determining factor in injury is a mechanical one the two great contributory factors are prematurity and asphyxia.

In the use of the forceps there are some elementary considerations to be disposed of. Can the force exerted by the forceps ever be made to act as favorably on the head as the natural forces? To approach this ideal as closely as possible certain principles must be observed: (1) The delivery of the head must be made slowly and gradually. Most operators, even experts, extract far too quickly. (2) The tractions must be intermittent and of short duration in order to avoid continuous compression and to allow the intracranial vascular system to return to a condition of rest. (3) To ensure that as small an object as possible is presented to the maternal passages, by correcting as far as possible faulty attitude and position of the head (i.e., manual rotation of an occipitoposterior position). (4) The varying curve and direction of the birth canal must be followed. A common fault is to begin extending the head before the occiput has cleared the pubic arch. (5) It is generally advisable to reduce the resistance by episiotomy or by "ironing out" the vagina and orifice. (6) The forceps must be applied accurately to the sides of the head, for if they are applied in the occipitofrontal range of diameters they will exert compression in a direction it is particularly important to avoid.

These principles are naturally followed by experts, and in their hands it may truthfully be said that the low operation is virtually without risk. But only a fraction of forceps operations is performed by experts, and the question arises as to whether the types of instrument could not be improved to render them safer in the hands of practitioners who are not specialists. The ordinary long curved forceps and the axis traction forceps were designed to aid delivery of the head obstructed in the

midpelvis or higher. The necessity for the performance of this operation seldom arises in these days of prenatal care. Yet in the medical schools students are taught the use of a heavy and powerful instrument that can be applied to the undescended head or when the os is not fully dilated. (We are all familiar with the tragedy of the "failed forceps.") Is this wise? Would not an immense amount of injury be avoided if students were taught the use of an instrument that could be used only when the head is low in the pelvis? Such an instrument has been designed by Wrigley and has much to recommend it. It is the Simpson short straight forceps to which the usual pelvic curve has been added to the blades. It is very lightly made (being only about one-fourth the weight of the ordinary long curved forceps), and its construction is such that it is impossible to exert a tremendous pull, so that the risk of head injuries should be greatly lessened.

An important problem concerns the delivery by forceps of the fetus with threatened or early asphyxia, as diagnosed by alterations in the rhythm of the heartbeat, usually slowing. We now know that "traumatic cerebral asphyxia," often followed by generalized asphyxia, is not uncommon. The effect of applying forceps to a head already traumatized may be to increase the trauma and kill the child instead of saving it. I still follow the traditional practice of delivery with forceps if the head is low and the os full, in cases of fetal distress; but the point has now become a controversial one.

The prevention of injury in breech labor has already been referred to. As for the so-called "prophylactic forceps" operation, I am not impressed by the arguments of those who advocate it (J. R. Goodall, and DeLee), possibly because of a traditionally conservative training, but largely because of what I have learned at first hand about intracranial injury. The deep episiotomy is a disadvantage to a childbearing woman, in that it prevents her from losing the disadvantageous state of nulliparity as far as her pelvic floor and perineum are concerned. As regards induction of premature labor, so far as the child is concerned it should be restricted to cases of real necessity, and they are very few. F. Browne has proved that cerebral hemorrhage is sixteen times more frequent in premature than in mature babies; and there is, besides, a considerable neonatal morbidity and mortality.

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8 Queen Anne Street

DISCUSSION

DR. HUGO EHRENFEST, St. Louis, Mo.—That the fetal head in the course of labor can sustain more or less marked traumatic injuries has been known for a very long time. Some of those present may recall the amusing discussion of possible damaging effect of labor on the child's head, presented about 175 years ago, by Laurence Sterne in his delightful *Life and Opinions of Tristram Shandy.* There he describes how by the tremendous expulsive force of the laboring uterus the lax and pliable head is compressed and molded into "the shape of an oblong, conical piece of dough." Whimsically Tristram's father exclaims: "Good God! what havoc and destruction must this make in the infinitely fine and tender texture of the cerebellum." "No wonder the intellectual web is so rent and tattered as we see it."

Just about a hundred years ago, Cruveilhier presented in his pathologic-anatomic atlas some excellent illustrations of intracephalic hemorrhages observed in newborn infants. Accurate information in regard to the anatomic nature of such damage began to accumulate with the introduction, by Beneke in 1919, of a new method of opening the infant's skull at autopsy. In this manner was revealed the important fact that most often the intracranial hemorrhages are the result of an injury to the dura and especially of the tentorium. This brief historical survey must be concluded with the statement that we owe to the studies of Professor Holland the present clear insight into the mechanical factors which cause certain dura folds to tear.

In contrast to all other mammals, in whom the skull of the newborn is a solid capsule and intracranial injuries are unknown, the cranium of the human fetus consists of loosely connected flat bones. This permits the required changes in configuration of the head during the second stage of labor, and thus its adaptation to the varying spatial conditions at the various levels of the bony pelvic canal. Molding does not result in any reduction of the volume of the skull but solely in alterations of its shape, the shortening of diameters by compression in one direction being accompanied by a corresponding lengthening of diameters in a perpendicular direction. It is the function of the dura folds to prevent excessive lengthening in certain directions, and therefore excessive compression in another direction. Dr. Holland has taught us to understand these strains and stresses developing within the cranium.

The intimate relation of intracranial damage to difficult or unskillful forceps extraction or to quick expulsion of the head as the result of an overdose of pituitrin is generally recognized. This fact by itself cannot, however, be used as an argument against any effort to shorten or lighten the discomforts of the parturient woman by operative interference. The continued, forcible pounding of a fully compressed head in the pelvic outlet against a rigid pelvic floor certainly implies greater danger to the fetus than an episiotomy followed by the gentle lifting out of this head with a forceps.

Strains of a different sort arise during the passage of the aftercoming head in a breech labor. It is surprising that obstetricians, even many who write textbooks, still fail to appreciate that fetal death in breech labor is only rarely due to asphyxiation, as formerly thought, but as a rule to intracranial damage, most often as the result of undue haste applied for the purpose of avoiding the presumably dangerous asphyxiation. The timely and correct extraction of the head by means of Piper's forceps undeniably affords to the aftercoming head great protection against injury.

However, the best prophylactic measure against damage to the aftercoming head is an external version gently done about six weeks before term without the use of any anesthetic.

It seems to me a significant fact that statistical records, first supplied by German clinics, ascribing about one-fourth of all fetal loss during labor to fatal intracranial injuries, have been consistently confirmed by reports later coming from all parts of the world. There undeniably are marked differences in the rates of operative deliveries in Great Britain, France, Japan, Brazil, Holland, and the United States, but everywhere careful autopsies in large series made on all newborn infants, stillborn or dying within the first forty-eight hours, uniformly show a 25 per cent mortality due to intracranial damage. In our fetal mortality statistics the incidence of birth injuries as the certified cause of death is gradually increasing but still remains far below the figure of 25 per cent where it should actually be. Physicians have become better acquainted with this important cause of fetal loss and are becoming less afraid to enter this diagnosis on the death certificate.

It is true that for our country the rates both of birth injury deaths and operative deliveries are increasing, but this does not necessarily prove an immediate connection between these two facts. In my opinion these two rates have increased as the result

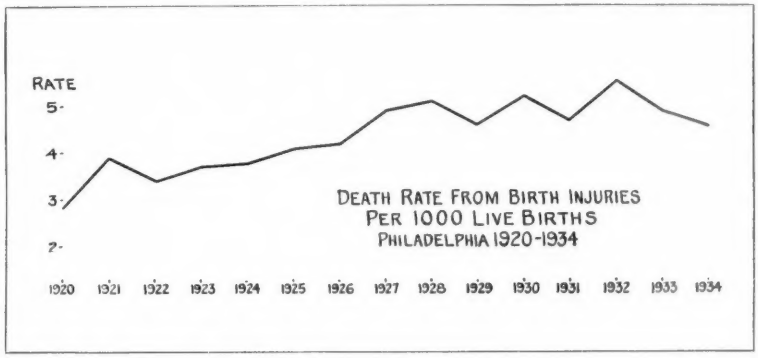


Chart 1.

of the remarkable increase in hospital deliveries, incidentally leading to more autopsies and more correct diagnoses of the cause of death. In the year 1935 a little over 13,000 babies were born in the city of St. Louis and over 10,000 of them, about 79 per cent, in hospitals. This seemed to me a strikingly high percentage, but I have just heard from Dr. Williams that also in Philadelphia the percentage of hospital deliveries amounts to 80 per cent of the total.

DR. PHILIP F. WILLIAMS, PHILADELPHIA, PA.—The first slide shows the frequency of birth injury in the stillbirths in the seven states and two cities which make up the stillbirth registration area of the United States. In 1933 the total stillbirths in that area were 17,000, of which about 22 per cent were caused by the type of birth injuries which Dr. Ehrenfest mentioned. I think we can consider that the dystocia group and probably a great many of the malpresentation group undoubtedly represent intracranial injury. We see therefore that a very large proportion of the deaths from birth injuries are occasioned by intracranial injuries.

The death rate among women who gave birth to stillborn babies is from four to eight times as great as in those giving birth to live babies.

From these graphs it will be seen that the death rate from birth injury has increased in the city of Philadelphia in the last decade and a half, slowly but surely. Whether this is due simply to the better recognition of birth injury deaths is hard

to say. Of course, Table I includes asphyxia and other causes of death, but a large proportion of these deaths must undoubtedly be due to birth injury.

Chart 2 shows the death of infants under one month from 1920-1934 in Philadelphia. The hospitalization of maternity cases has increased during this period from 18 per cent in 1920 to 80 per cent in 1934. Of course, we know that there are more obstetric operations performed in hospitals than upon patients treated at home. Whether that makes any difference we cannot say. The high peak was reached in 1932 when one out of every five children dying under one month died of birth injuries. We hope the recession at the present time will continue.

We know that in many of these intracranial lesion deaths the tear is of slight degree and the amount of hemorrhage is minimal. I would like to ask Dr. Holland to explain a little further the actual causation of death where at autopsy we find so little actual injury in that type of lesion.

We all know that the injury Dr. Holland described is not the only type of lesion that causes death. Any fetus that dies at birth necessitates an examination of the entire cerebrospinal system. A large proportion of birth injury deaths are occa-

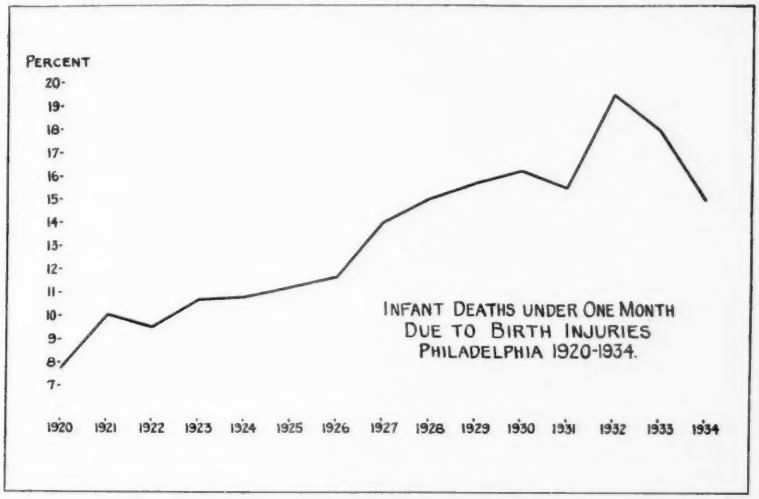


Chart 2.

sioned by the depression of the occipital bone with resulting pressure on the cerebellum. There have also been found large numbers of dislocations of the spinal column where intracranial injuries were also present. I would like to ask Dr. Holland to explain what part the change in the intracranial pressure plays in these cases.

TABLE I. NUMBER OF STILLBIRTHS DUE TO BIRTH INJURIES IN AREA FOR WHICH STILLBIRTHS ARE TABULATED BY CAUSE BY THE U. S. BUREAU OF THE CENSUS, 1933

CAUSE OF STILLBIRTH	NUMBER	PER CENT DISTRIBUTION
Total stillbirths	17,207	100
Due to birth injuries	5,097	30
Antepartum hemorrhage and hemorrhage of uterus	45	---
Placenta previa	443	---
Prolapse and compression of cord	1,568	---
Malpresentations	718	---
Difficult labor	1,495	---
Asphyxia of child (cause not stated)	828	---
All other and not specified or unknown	12,110	70

When we come to the discussion of prevention of birth injury deaths, we can sum up that the two most important points in prevention are wider application of the known principles of antenatal study of our patients and a more thorough consideration of the selection and technic of necessary operations.

DR. EDWARD A. SCHUMANN, PHILADELPHIA, PA.—Dr. Holland's little antelope was not only born without a forebrain and with closed fontanels, but was also born with face presentation. I preface my remarks thus because my experience has convinced me that in great measure the intracranial damage of the fetus occurs during the passage of the broadest diameters of the head through the inlet. That is where molding is at its maximum. That is when the tentorium and the falx are exposed to the most continuous and severe strains and stresses, and this is the location in which the severe lacerations occur.

It is perfectly true that continuous pressure during the second stage of labor while the head is in the birth canal may lead to asphyxia and to some degree of brain injury, yet experience with cesarean section in cases of dystocia convinces one of the fact that the major injuries take place in the pelvic brim. This of course takes no account of outlet compression, wherein great injury may result.

The figures of Sharp of New York, in which he obtained the bloody cerebral spinal fluid from lumbar punctures in 10 per cent of children following all types of delivery and including cesarean section cases consecutively, proves conclusively, to my mind, that it is not the ordinary type of forceps delivery which injures the child but the extreme molding and compression, which occur at the inlet.

DR. GEORGE W. KOSMAK, NEW YORK, N. Y.—Dr. Holland has opened up a very wide field for discussion of a problem which is agitating many people at the present time. He has referred specifically, however, as one of the main causes of fetal death, to dystocia, from malformations of the pelvis and ill-adaptation of the fetal head, and to an increased number of forceps deliveries. I think there is another factor which must be considered when we take up the subject of neonatal deaths, namely, the anesthetics and the analgesics so widely used today. Of course, the propaganda for painless labor has reached all classes and both wives and husbands come to the obstetrician with a demand that they desire a labor which shall cause as little pain as possible. Is it not to be considered that we have gone a bit too far in our promises to produce painless labor by the use of anesthetics and analgesics? Admitting, as we must, that it is necessary in some cases, analgesia in a large majority increases the length of labor and frequently interferes with the natural expulsive forces, necessitating instrumental interference in a great many instances. The use of nitrous oxide so commonly employed in the final stage, may delay delivery in many instances and produce a degree of asphyxia in babies which is not generally recognized. Dr. Eastman in his recent studies has brought out some of these facts. The same thing applies to the use of the barbiturates and the pharmacologists are now telling us that they may be transmitted to the fetus, passing through the placenta, and they have actually been found in the fetus and the amniotic fluid. Now, such delays in the natural processes of labor and such effects of anesthetics on the fetus must bear, it seems to me, a considerable share of the blame for these neonatal deaths.

The use of the prophylactic forceps does not seem to me to cause as much damage, especially in the terminal stage when the woman is unable to push that head over the perineum, as the use of the drugs that interfere with fetal respiration. I believe that we must not only regard instrumental deliveries as a factor in the production of these fetal deaths, but must also consider the various anesthetics and analgesics. A generation ago, before we knew much about the barbiturates, before we knew much about gas-oxygen anesthesia, we used chloroform by the drop method,

and I often feel that for the instruction of medical students and of the general practitioner in obstetric procedures, it might be well if, instead of stressing the employment of these other measures, we went back perhaps to the inhalation anesthetics. Their administration can be regulated and it seems to me that they cause less damage so far as the prevention of asphyxia neonatorum is concerned.

DR. PAUL TITUS, PITTSBURGH, PA.—Dr. Ehrenfest might have continued his quotation from Tristram Shandy somewhat further, thus emphasizing that this problem of whether "to forcep or not to forcep" is already several centuries old.

You will recall that when Dr. Slop was called because Mrs. Shandy had fallen into labor, he left home in such a hurry that he forgot to take with him his instruments. These were his tire-tête, his crochet, his squirt, and his new invented forceps, which were left hanging, in a green baize bag, on his bedpost. Consequently when the omission was discovered, Obadiah, the man-of-all-work, was dispatched posthaste on horseback to fetch them.

Obadiah, fearing to lose the instruments while galloping back, tied the strings of the bag into a double hard knot. When he arrived, Dr. Slop had so much difficulty in getting the knots untied that there was considerable doubt whether he would be able to get at his forceps before Mrs. Shandy should deliver herself spontaneously.

DR. JAMES R. GOODALL, MONTREAL, CANADA.—I regret to have to disagree with Dr. Schumann, when he states that injuries of the baby's head occur at the pelvic inlet. It is well known that birth injuries occur in a large number of cases where there is absolutely no disproportion, and they also occur most frequently in primiparas. Therefore, they cannot be due to any disproportion between mother and child, but are the results of dystocia of the soft parts.

Birth injuries occur in the first and second stages of labor, but in the first stage, only when the labor is dry. The majority of cases occur in the second stage, and are due to asphyxia, which is of two types, the acute and cumulative. The acute is the result of prolonged spasm of the uterus, while the cumulative is due to the child carrying over a percentage of anoxemia after each pain, when the uterine pains are unduly long and the intervals too short to permit complete aeration.

There is nothing more productive of brain hemorrhage than high grades of anoxemia. Much of the damage it has done to the baby's head has been attributed to the use of forceps. The use of forceps is unduly delayed in the majority of these cases, and the damage to the baby's head has already occurred before they are applied. The injury is, nevertheless, attributed to the pressure of the forceps, although it has been proved recently, by my own writings, and those of others, that the frequent use of prophylactic forceps has reduced the incidence of brain injuries over 50 per cent.

A very easy test to determine whether the baby is suffering from brain hemorrhage as a result of dystocia or the fetal heart distress is merely due to asphyxia is found in the use of chloroform. If one administers chloroform under these circumstances, one finds the fetal heart rate returns to normal very quickly, if there is only asphyxia, but if brain hemorrhage has occurred, the return of the fetal heart to normal does not take place. This test seldom fails to give one accurate information concerning the child's cerebral state.

DR. FRED L. ADAIR, CHICAGO, ILL.—Dr. Holland emphasized the relative immaturity of the term "fetus." I would like to stress that point, carrying it back a little farther in gestation, stressing the idea that the premature fetus is much more susceptible to these injuries than the fetus at term. There are a certain number of patients with chronic disease in whom it may be necessary to terminate

the pregnancy and to perform an operation for sterilization. In these cases cesarean section may afford a much better prognosis for the infant, especially if premature.

I am in agreement with Dr. Goodall that while intracranial injuries may occur from injury at the inlet, the most frequent cause of intracranial injury is after the head has passed the inlet. It is not only the degree of compression of the head, but the duration of that compression which is an important factor.

Many of these intracranial injuries either occur or are aggravated by delivery through the outlet. I would like to stress again the importance of depression of the occipital bone in association with deliveries through the outlet, and also to mention the likelihood of the Ritgen maneuver with forcible pressure against the pubic arch being a possible cause of intracranial injury.

DR. HOLLAND (closing).—I do not think that the death rate from birth injuries is increasing. What is increasing is correct certification, and the very fact that in cities like Philadelphia 80 per cent of the babies are born in hospitals surely will favor correct certification.

Dr. Williams asks a very important question, namely how to account for death in cases where there is scarcely any cerebrospinal hemorrhage or any injury. It is due to what I call traumatic cerebral asphyxia. If the head is subjected to sufficient pressure and to sufficiently prolonged pressure, the intracranial tension will so rise that the cerebral sinuses and veins are obstructed with the result that the brain and medullary structures become asphyxiated. When the brain and medullary centers become asphyxiated, the respiratory center is stimulated. If the fetus makes respiratory efforts, the intrathoracic pressure becomes negative and there is a pouring of blood into the thorax. There will then arise venous obstruction of the heart and the accompanying rise in intravenous pressure will give rise to these petechiae which I showed you on the screen. Of the cases to which Dr. Williams referred nearly all show very intense development of petechiae. If the asphyxia continues, the center becomes paralyzed and the baby dies in utero. That, I think, is the explanation of the deaths in these cases of trauma which do not show gross injury, but what I call traumatic cerebral asphyxia.

I may also repeat what Dr. Goodall said. I think the pelvic reserve is immense, as the radiogram or a typical examination shows. Furthermore nearly all of the head has gone a long way past the brim before labor starts, and I do not think there is damage to the head as it is going through the brim unless there is pelvic disproportion.

I agree with Dr. Kosmak about analgesics, but we have got to give them, for if we do not nobody will come near us. I think barbiturates are very dangerous indeed, and believe they kill mothers and also babies.

Seguy, J.: Etiological and Clinical Study of Sterility, Rev. franç. de gynéc. d'obstét. **31:** 280, 1936.

The problem of sterility has become too complex. To achieve success in its solution it is essential for the biologist, chemist, pathologist, and physiologist to work together with the gynecologist. Also the urologist must cooperate because it is illogical to dissociate male sterility from female sterility. Biochemists interested in research on hormones should prove especially helpful in the study of sterility.

J. P. GREENHILL.

INCONTINENCE OF URINE IN THE FEMALE*

Some Functional Observations of the Urethra Illustrated by Roentgenograms

William T. Kennedy, B.A., M.A. (Hon.), M.B., L.M.C.C., F.A.C.S.,
New York, N. Y.
(From the Clinic of the Woman's Hospital)

THIS paper is an unprejudiced endeavor to evaluate the loss of urethral function that women suffer who are afflicted with incontinence of urine, and to develop a method whereby I might improve my disheartening results while trying to alleviate this disturbance. No congenital defects, no vesicovaginal fistulas, no absence or loss of the urethra, no case with a known impaired nerve supply, and no operative procedures are included. The paper is a study of the function of the urethra in cases where the nervous control of the urethral sphincter is considered to be functioning normally. The urethra with normal function, before labor or operation upon the anterior vaginal wall, which to have lost some of its control following labor or operation, seems to me has suffered injury to the muscle or supporting structures of the sphincter mechanism and has preserved its nervous control unimpaired. On this assumption the study was begun.

Incontinence of urine in the female, if present to such a degree that any form of exertion makes the patient wet her clothes, drives her to give up routine social duties. She seeks a hospital where she pins her hope on getting relief, is operated upon and leaves, in many instances, with little or no improvement over her previous state and is sometimes worse. From this time on she remains at home, believing that any further attempt to relieve her will be of no value. If she likes to go about and does not wish to be an invalid, she justifiably makes this fact known in the hospital and I admire her persistence. If she submits to further operation and fails in a second attempt, she will give up, and we do not get further opportunity to help her. Being continually wet she is burdened with a condition more distressing than rectal incontinence where, in many instances, the escape of feces is only intermittent.

Reports of results and failures are taken from three papers. H. A. Kelly and William M. Dumm,[1] reported on 20 cases of incontinence with success in 16, or 80 per cent, and complete failure in 4, or 25 per cent. B. P. Watson,[2] reporting on 105 cases followed after operation, had complete success in 65.7 per cent (2 out of 3), had 21.9 per cent where the control was better than before operation, and 12.4 per cent (1 out of 8) with no improvement. H. Dawson Furniss[3] reports his results in 21 cases, 8 being minor in character, 9 having marked incontinence, and 4 having complete incontinence. In his follow-up 4 of these patients

*Read at a meeting of the New York Obstetrical Society, March 10, 1936.

were not heard from. Of the 17 cases, 6 were mild, all of which were successes; of 7 who had marked incontinence, 5 were successes, 1 was a partial success, and 1 was a failure; of the 4 with complete incontinence, 2 were successes, 1 was moderately benefited, and 1 was a failure. In the 17 cases, 13 were complete successes or 76.5 per cent, while there were 2 failures or 12.9 per cent.

Marion Douglass,[4] in a recent study, states: "the anatomy of the vesical neck is insufficiently understood. The vesical neck is produced by thickening of the musculature and submucosa which forms the layer about the orifice which functions as a sphincter, i.e., the sphincter vesicae internus. In addition, but in the female essentially, continuous with the structure of the vesical neck there is an external sphincter which is essentially voluntary in function." Victor Bonney[5] feels that while there is a sphincter it is only one factor in the sphincter mechanism and probably the least important, and there is probably still a good deal of ignorance on the subject.

The nervous mechanism cannot be overlooked. The bladder has three such mechanisms: (1) Intrinsic within the bladder musculature, the weakest of the nervous controls; (2) the lower spinal cord reflex, having perhaps the strongest control; (3) voluntary control, acting from the cerebrum through the abdominal muscles. In the urethra the external sphincter is smooth muscle with motor and inhibitory impulses passing between it and the hypogastric ganglion. Afferent motor impulses pass from the posterior urethra through the pudic nerve to the anterior primary division of the sacral nerves and back to the external sphincter. The internal sphincter is smooth muscle and is under the control of the hypogastric ganglion with motor and inhibitory impulses passing between them. Whether there is any voluntary control surrounding the urethra and whether there is more sphincter control than at present acknowledged is a question I have asked myself. Wherein does the supporting structure play a part?

Victor Bonney[5] speaks of observing a layer of tissue with fibers running transversely below the urethra and probably some fibers surrounding the urethra, some of these fibers being muscle. He found the bladder attached to the back of the pubis by thin fibers. Edward Martin,[6] in his atlas, *Der Haftapparat*, Plate IV,[5] illustrates the attachment of the bladder to the posterior symphysis. Fibers begin in the middle umbilical ligament, spread out over the anterior wall of the bladder longitudinally and come together, separate portions attaching themselves to the posterior of the symphysis forming the pubovesical ligament. B. P. Watson found that out of about every three patients having incontinence, two had cystocele as a complication. He states further that "in all patients presenting this symptom there is a marked sagging away of the bladder from its proper situation behind the pubis; very often it is a marked sagging of the whole of the anterior vaginal wall and bladder in the form of a cystocele. In many, however, the cystocele may not be pronounced, or may be absent. In some cases of complete procidentia where both vaginal walls are completely everted, control may be perfect; in such it will be found that the neck of the bladder remains braced up in its normal situation. The sagging of the neck of the bladder away from the back and under aspect of the symphysis is very easily demonstrated by introducing a catheter or sound into the bladder. On exerting a little pressure the lower end of the anterior vaginal wall can be made to bulge at the vaginal orifice and a small stream of urine will often escape alongside the instrument. I believe that it is this sagging of the neck of

the bladder with its surrounding sphincter away from its normal attachment, rather than damage to the sphincter itself, which is the cause of incontinence. The sphincter has lost its *point d'appui,* and so fails to act efficiently.'' His operation consists in a very careful and thorough dissection and suturing to restore these supports. Victor Bonney does a similar procedure and believes that failure results because the attachment of the pubocervical ligament has become loosened beyond where it can be repaired from below.

Realizing that the best follow-up published shows a failure of one in eight, and knowing that my own were very much inferior, I felt that we should not send our failures away but should make a study of their condition. They really need our help and if we are able to relieve them then the easier ones should give no trouble. Consequently, at the Woman's Hospital, I began to study patients who presented themselves for the first time, patients who became incontinent following operation for cystocele who previously were continent and patients who had failed to get relief after one or more operations. Roentgenograms of the bladder are not new. Charles C. Norris a number of years ago showed the funnel shape of the bladder opening into the urethra.

METHOD OF OBTAINING ROENTGENOGRAMS

In the beginning a simple rubber sac was connected to a manometer in which the roentgen opaque fluid was a solution of sodium iodide. Pressures could be measured at the time pictures were made. The contour of the urethra could be outlined but little stretching of the sphincter muscles of the urethra could be obtained because of the extreme elasticity of the sac wall.

A new apparatus was designed (Fig. 1). A metal tube *C* 6 cm. long was taken and a rigid arm was attached at one end. Rotating about it was a guard *G*, which, when in contact with *C*, could be kept close to the external meatus of the urethra. The guard *G* was so placed that the tube *C* could extend 1 cm. into the urethra. The sac *S* was a two-layer membrane—the outer fishskin, the inner very thin rubber—was about 2.5 cm. in diameter when fully dilated and was firmly attached to *C* at the point where the guard *G* came in contact with it. The length of the sac *S* was about 5.5 cm. Connected to the other end of *C* was a rubber tube leading to the manometer *M*. The manometer, connecting tube and sac were filled with a 25 per cent solution of sodium iodide and the level of the surface of the solution in *M* above the level of the urethra measures the pressure in the sac. Strongin suggested that pictures of the bladder should be taken at the same time, consequently 200 c.c. of a 3 per cent solution of sodium iodide was put in the bladder before the sac was put into the urethra. To insure a uniform manometer pressure in that portion of the sac in the bladder, a section of a ureteral catheter *A*, with a metal collar *K* at one end and a cork *B* for the other was made and this ran from one end to the other as illustrated in Fig. 2.

The steps in making a picture are as follows:

1. Prepare the patient similarly as for a cystoscopic examination. Introduce a catheter to allow all urine to run out of the bladder, then introduce 200 c.c. of a 3 per cent solution of sodium iodide through the catheter into the bladder and remove the catheter. Now insert *A* into *D* through its open end *F*, then push *D* into *C* and this acts as an obturator to introduce the sac into the urethra sufficiently

far for the guard *G* to rest against the external orifice of the urethra. Attach a 20 c.c. Luer syringe containing 25 per cent sodium iodide solution to *L*, the end of *D*, and slowly empty the contents of the syringe into the sac while *D* is with-

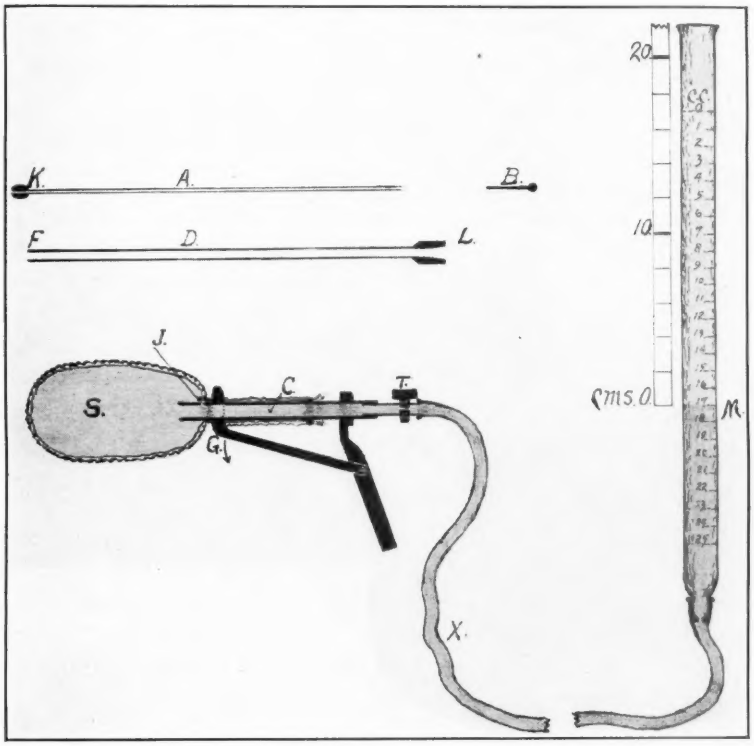


Fig. 1.

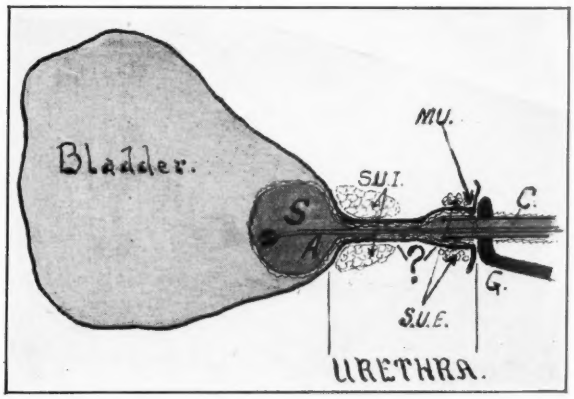
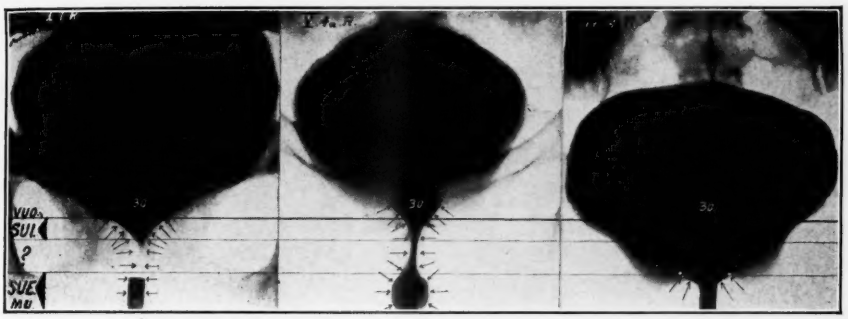


Fig. 2.

drawn, leaving *A* within *C*. Attach the manometer tube to *C*. Raise the manometer tube *M* to obtain the desired pressure in the sac. Each picture obtained reveals separately the contour of the bladder and the contour of the urethra, since the solution in the bladder has different opacity from the solution in the sac. The

relationship of the bladder to the urethra can be observed and at the same time the pressure in the sac is always at right angles to surface, consequently at right angles to the inner surface of the urethra. The pressure in the urethra is equal and opposite in direction to the force exerted at right angles to the urethral sphincter muscles as they contract to prevent the escape of urine from the bladder. When the pressure in the sac is varied, one can arrive at an estimation of the efficiency of the sphincter control. The involuntary sphincter control is mainly exerted by fibers about and near the internal and external thirds of the urethra. For arbitrary reasons in this paper the urethra has been divided into an inner, a middle, and an outer third; and the efficiency of the sphincter about each portion is estimated. Pictures were made at different pressures when a patient was relaxed (R throughout), i.e., when she made no effort to void and no effort to hold her urine. Pictures were also made with a constant pressure (1) when relaxed (R throughout), (2) when an effort to hold her urine was made (H throughout), and (3) when an effort to void was made (V throughout the paper). The following insignia appear in the illustrations: *SUI* sphincter internal urethra; *SUE* sphincter external urethra; *MU* external urethra; *VUO* vesicourethral orifice.



A. *B.* *C.*

Fig. 3.

Three roentgenograms appear in Fig. 3: The first (A) is a roentgenogram of a *normal* urethra and bladder with 30 cm. of fluid pressure in the sac. The external pressure exerted by the urethral sphincter is in the direction of the arrows. It will be seen that the pressure which the sac exerts against the internal sphincter tends to stretch it outward from the urethral axis and the counter pressure exerted by the internal sphincter tends to force this part of the sac with fluid in it farther into the bladder which tends to make the remainder of the sac a cylindrical wall. However, the middle third of the urethra has some sphincteric force about it greater than 30 cm., since the urethra is here constricted. An entirely different picture appears in B. Here we see the external sphincter stretched out to a considerable diameter, the internal sphincter less stretched and nearly normal, but the middle third still has a sphincteric constricting force greater than 30 cm. of fluid pressure. In this particular instance the sphincter action about the middle third is greater than that about either the outer or the inner third. Here the inner also has a greater constricting force than the outer.

C presents a rather distressing picture, where, under 30 cm. of water pressure the sphincteric force about both the inner and middle thirds of the urethra have been completely overcome and only the external sphincter is exerting any constricting force. This patient has a definite incontinence. This leads one to believe that there is a third sphincter surrounding the middle third of the urethra, having a greater constricting force than the sphincter surrounding either the inner third

or the outer third. The sphincter about the internal third is normally stronger than the sphincter about the outer third. Further on in this paper the author will present evidence to show that the inner third is protected and will function better when the sphincter about the middle third is strong and functions well, and is well supported. One here asks himself the question: Is this sphincter about the middle third smooth muscle and a continuation of the inner sphincter fibers, and in addition supported by a sling of voluntary muscle fibers, holding it up under the pubic arch by attachments to each posterior aspect, or is it composed of both smooth and striated fibers, the striated fibers surrounding the urethra and having their ends attached to the posterior aspect of the symphysis? Either arrangement would satisfy good function and any operation to restore such anatomical function should restore continence where incontinence exists.

CASE REPORTS

CASE 1.—This patient, aged twenty-three years, complained only of sterility; had no dysuria, no nocturia, but had a retroverted uterus. The pictures taken of this patient's urethra and bladder shown in Fig. 4 are consequently of a *normal* urethra and bladder and were made when she was relaxed, i.e., making effort neither to hold her urine nor to void. The pressure in the sac was varied, and pictures were

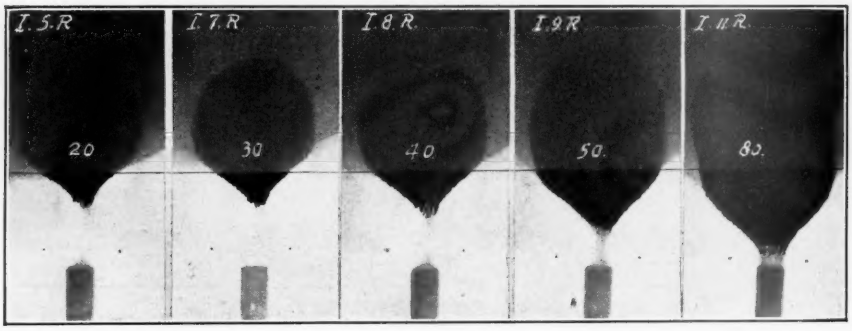


Fig. 4.

taken at 20 cm., 30 cm., 40 cm., 50 cm., and 80 cm. It will be noted that the first indication of the internal sphincter's dilating takes place between 30 cm. and 40 cm. fluid pressure. The middle third of the urethra does not begin to dilate until a pressure between 40 cm. and 50 cm. is reached, is not nearly stretched at 50 cm., and still has some sphincteric control at 80 cm. of pressure.

CASE 2.—This patient was in the hospital first in 1933, and complained of incontinence of urine for previous eight years. She had had 8 full-term pregnancies, the last in 1923. No repairs were done at delivery. Incontinence had become progressively worse. She wore a pad constantly and any walking or straining caused leakage. When lying down there was little loss of urine. Wassermann was four-plus; urine negative; operation, dilatation and curettage, amputation of cervix, operation for incontinence (Kelly stitch), operation for cystocele, rectocele, and lacerated pelvic floor. Still had incontinence when she appeared for her ninth pregnancy in 1934. Pelvic floor repaired at this delivery. Incontinence persisted. Entered the hospital in 1935 for another Kelly stitch, which was still a failure. Fig. 5 represents a series of pictures taken at 0, 10, 20, 30, and 50 cm. fluid pressures successively. The internal sphincter appears as much dilated at 20 cm. as the normal did at 40 cm. pressure, and much more dilated at 30 cm. than the normal was at 50 cm. Most of the sphincter about the middle third of the urethra has been set aside at 30 cm. pressure.

This patient was operated upon by a new method which has given her complete continence of her urine and pictures made fifty-two days after operation are shown in Figs. 11 and 12. Fig. 11 shows the comparison of the sphincter function before and after operation at 30 cm. pressure when the patient was relaxed. Fig. 12 is a composite picture: the dots represent the position of the bladder and urethra in a state of relaxation and the dashes illustrate the position of the bladder and urethra while the patient endeavors to void. One sees that the effort to void does not press down the urethra and that the sphincteric action about its middle third has been restored.

CASE 3.—This patient, aged forty-one years, had had three full-term pregnancies and was badly lacerated. A prolapse of the uterus appeared and she was operated

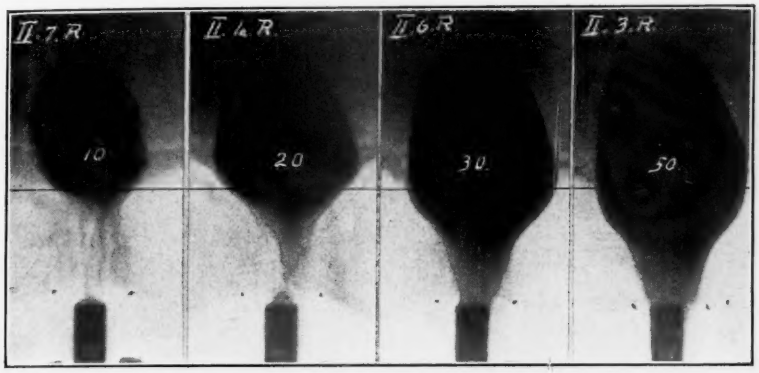


Fig. 5.

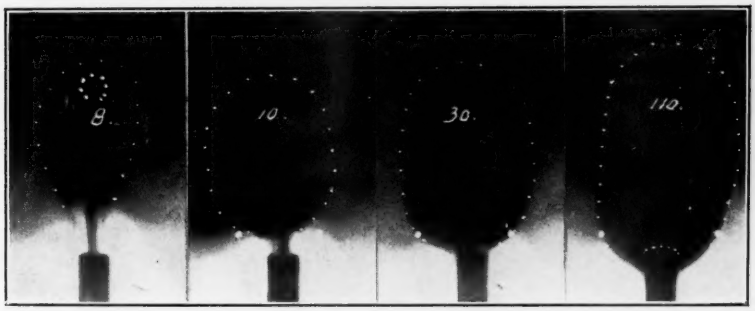


Fig. 6.

upon for the prolapse, but one year later it recurred as did also a cystocele. The incontinence was more marked. Roentgenograms were made and are shown in Fig. 6 at pressures of 8, 10, 30, and 110 cm. successively. It is noted that the middle third of the sphincter of the urethra is more set aside at 10 cm. pressure than the normal was at 80 cm., that at 30 cm. pressure the external sphincter begins to be pressed out and at 110 cm. pressure much of the external sphincter has been stretched.

CASE 4.—This patient, aged thirty-three, had had two full-term pregnancies, the first instrumental. Complained of something coming down, urgency and frequency, but no incontinence. Had metrorrhagia with frequent clots. A dilatation and curettage, amputation of the cervix and operation for cystocele were done. Operation with wide dissection was done and two sutures (Kelly stitch) were placed below

the urethra. Fig. 7 shows three composite pictures of lateral views. The upper shows how much more urethral sphincter is pressed aside at 25 cm. than at 10 cm. The middle shows the excursion of the urethra from a position of relaxation to one of voiding at 25 cm. pressure. The lower shows that at both relaxation and voiding at 25 cm. pressure the sac remains the same size.

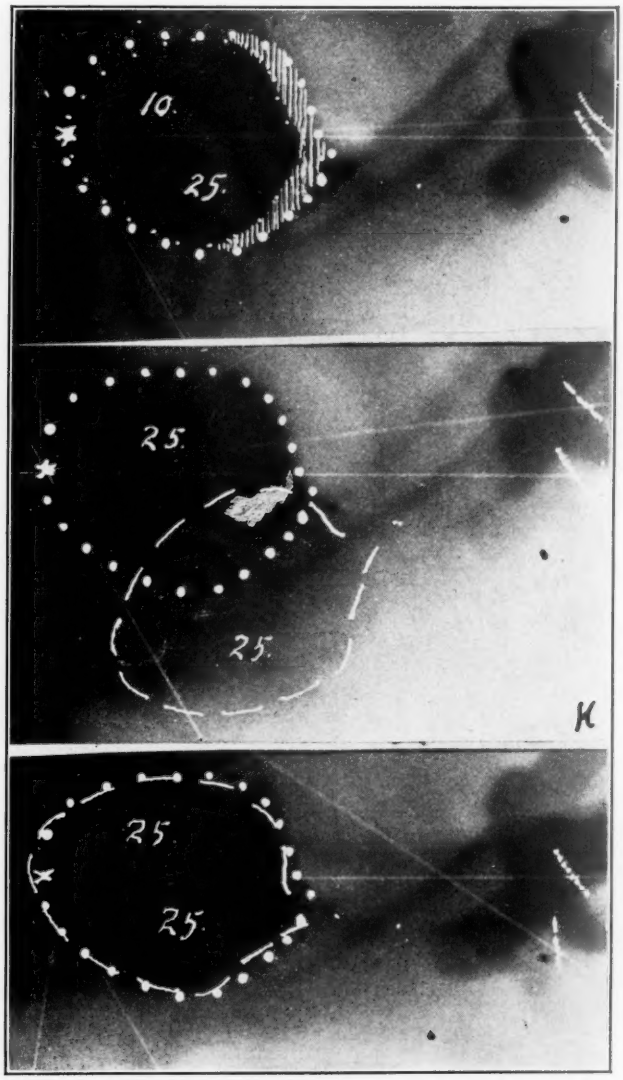


Fig. 7.

CASE 5.—This patient, aged forty, had had incontinence for two years. She had a large myoma which distorted the bladder and apparently pressed also on the urethra. The operation consisted of a supravaginal hysterectomy, separation of adhesions and a bilateral salpingo-oophorectomy. One month after operation she still had some incontinence but this is much improved. Fig. 8, the first picture, shows a marked stretching of the internal sphincter and considerable stretching of the sphincter about the middle third when she is relaxed. However, the second

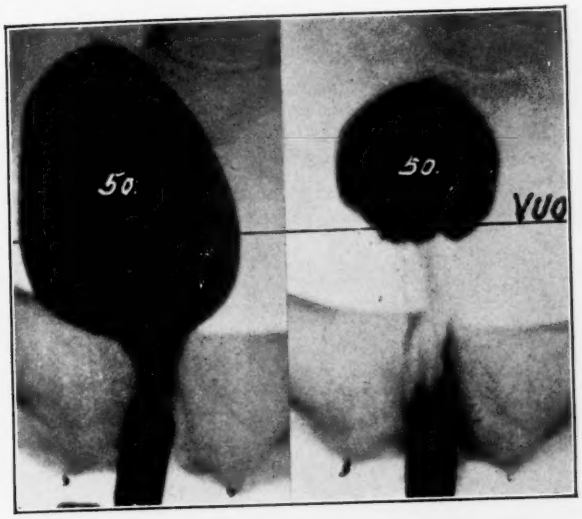


Fig. 8.

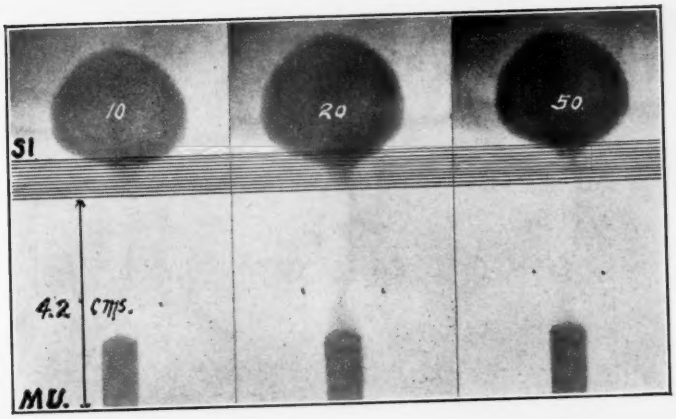


Fig. 9.

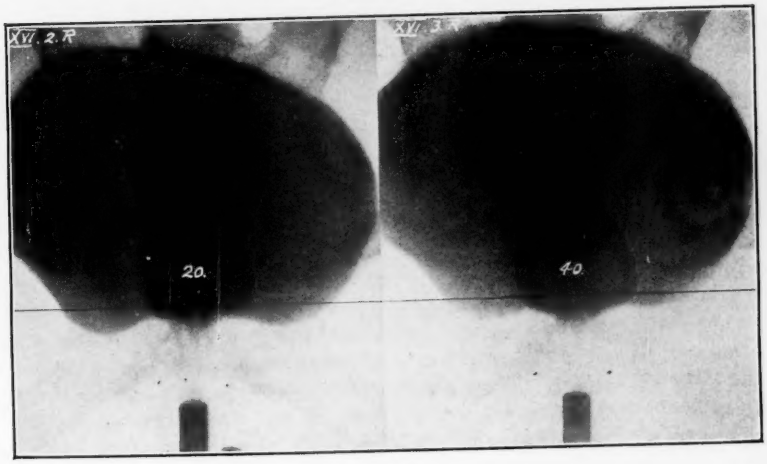


Fig. 10.

picture, taken while voiding, shows she can empty the sac and at the same time constrict both the internal sphincter and the sphincter about the middle third even at 50 cm. pressure.

CASE 6.—This patient, aged forty-three years, had no incontinence but only frequency and urgency. She had had one full-term pregnancy. Due to difficulty of catheterizing, a stricture of the urethra was found which began 4.2 cm. from the external meatus. Fig. 9 illustrates a urethra which does not stretch even about the inner third. The width of the stricture is shown by the parallel lines. The

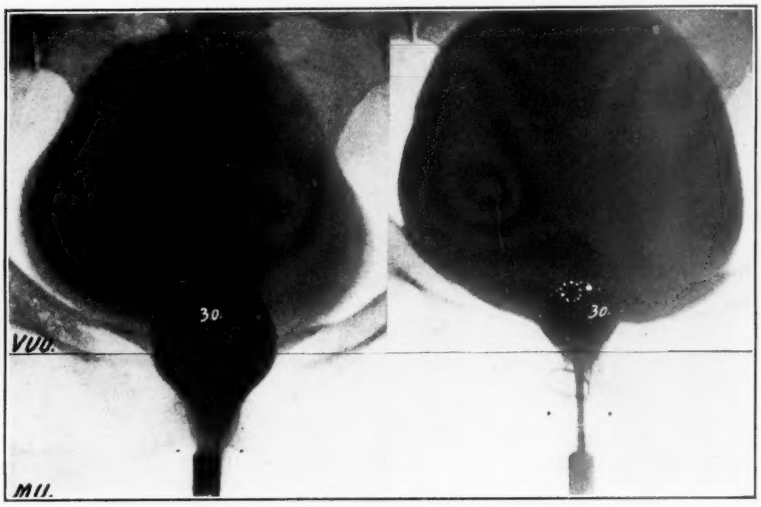


Fig. 11.

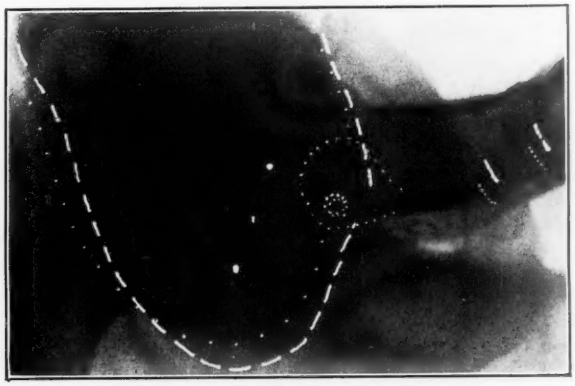


Fig. 12.

stricture here acts as a guard near the junction of the middle and inner thirds, preventing any undue strain from injuring the inner third sphincter and allowing it to function normally.

CASE 7.—This patient, aged thirty-eight, complained of incontinence while laughing, sneezing, and coughing. She has had 6 full-term pregnancies and she was torn at the birth of the first child. The operation done one year ago consisted of a dilatational curettage, an amputation of the cervix, and a reconstruction operation for incontinence, but the incontinence was worse after operation. Unfortunately the study on this case before operation was one of the earlier cases and was of no value.

She has had a complete hysterectomy and appendectomy. The bladder was separated from the anterior vaginal wall well down below the trigone and plicating sutures were placed about the inner third of the urethra and in the trigone. Fig. 10 illustrates the urethra at pressures 20 and 40 cm. successively in the sac. Much similarity appears in this picture to the one where the stricture existed; the sutures apparently constricting the inner third of the urethra. Three months after operation the patient was continent and symptom-free. This stricture seems to support and fortify the sphincter about the inner third, enabling it to function much more effectively.

CONCLUSIONS

1. The average length of the urethra is between 4 cm. and 4.5 cm., and there is a sphincter muscle around it throughout its whole length.

2. While there is an involuntary sphincter muscle about each of the inner and outer thirds of the urethra, there is an additional sphincter about the middle third which is probably under voluntary control. This control is greater than that of either involuntary muscle.

3. The interposition of the uterus between the bladder and the vaginal wall will not improve an incontinence, but plication of the urethra near the trigone will in some instances produce a mild stricture and help much to restore continence.

4. There is a pressure (about 30 cm. of fluid) which, if when exerted it stretches the sphincter about its middle third, justifies one's suspecting some degree of incontinence.

5. The causes of incontinence are (1) trauma of the inner and middle third sphincters of the urethra causing them to become partially fixed by fine bands to the posterior lateral margins of the adjacent pubic rami, and (2) damage in the midline to those voluntary fibers which pass under the middle third of the urethra and are attached to each ramus of the pubis, posteriorly constituting a "sling" support.

6. It is possible to relieve or cure incontinence by (1) breaking down the fine bands between the urethra and each posterior lateral portion of the ramus and plicating the urethra in its midline vaginally, to prevent any further connection with the ramus laterally and (2) bringing together in the midline beneath the inner and middle thirds of the urethra, the uninjured portions of the "sling" fibers which are themselves attached to the posterior of the ramus, in a lateral direction from the urethra. (Description of operation to appear in another article.)

The author extends his acknowledgment and thanks to Dr. George Gray Ward, Chief Surgeon of the Woman's Hospital, for the privilege of undertaking this study; to Dr. Edward A. Bullard for his generosity in assigning satisfactory cases to me; to Dr. A. J. Murphy for cystoscopic assistance; to Dr. H. C. McIntosh for her x-ray experience and suggestions and to Miss Helen Cronin for her skill in taking the roentgenograms.

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79 East Ninety-First Street

OVARIAN RUPTURE CAUSING INTRAPERITONEAL HEMORRHAGE*

With Report of Ten Cases

S. Leon Israel, A.B., M.D., Philadelphia, Pa.

(From the Departments of Gynecology of the Mount Sinai Hospital and of the Hospital of the University of Pennsylvania)

THE exact incidence of intraperitoneal hemorrhage resulting from rupture of the ovary, in the absence of pregnancy, is not known. Prior to the surveys of von Beust[1] and of Novak,[2] medical literature contained less than 50 single case reports. In 1926, Brakeley and Farr[3] reported 15 cases. By 1931, the total of published cases had reached 94 (Morton[4]). The larger number of single cases and series reported during the last five years (Boggon and Wrigley,[5] Sackett,[6] Masson and Phillips,[7] and Hoyt and Meigs[8]) indicates a growing appreciation of this clinical entity. More than 300 cases have been reported to date.

The earlier reports do not distinguish with sufficient clarity between follicle and corpus luteum rupture to warrant an estimate of the respective frequency of each as a cause of intraperitoneal hemorrhage. However, study of the more recent surveys indicates that corpus luteum perforation is by far the more common lesion. The preponderance of reported corpus luteum perforations may be explained, in part, by the fact that the resultant hemorrhages are greater and more productive of symptoms than those accompanying follicle perforations.

ETIOLOGY

Rupture of the graafian follicle is a normal occurrence in the ordinary cycle of ovarian activity. It is accompanied by little bleeding because the tenuously stretched point of perforation (stigma) is relatively avascular. However, moderate hemorrhage may occur when abnormal conditions which cause hyperemia of the thecal vessels adjacent to the stigma are present. Rupture of the corpus luteum, on the other hand, is an unnatural phenomenon and is generally accompanied by frank bleeding. The premenstrual hyperemia and capillary hemorrhage give rise to a corpus luteum hematoma (Teacher[9]) which, if sufficiently intense, may rupture spontaneously through the stigma, lacerate the adjacent thecal vessels and cause intraperitoneal hemorrhage.

In the presence of inflammatory ovarian congestion, or during the period of normal corpus luteum vascularization, sudden trauma may be the exciting factor (Shaw[10]). However, a history of trauma is difficult to evaluate. Corpus luteum perforation has occurred following

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an abdominal blow (Christopher[11]), during quiet sleep (Johnston[12]), and during coitus (Klein,[13] Payne,[14] Johnson,[15] and Stuckert[16]). Ovarian rupture has occurred during the performance of ordinary activities, such as walking, dancing, and washing clothes (Novak[2]). The possibility of ovarian rupture and intraperitoneal hemorrhage following bimanual (pelvic) examination is known to gynecologists (Crousse,[17] Greenhill,[18] Pratt,[19] and Novak[2]). Schumann,[20] having demonstrated focal endarteritis in several instances of ovarian rupture, is of the opinion that normal ovaries do not give rise to massive hemorrhage. Ovarian hyperemia resulting from chronic oophoritis may give rise to abnormal ovulation (dysovulation) and hemorrhagic follicular rupture (Hirshfeld[21]). The opinion of Forssner,[22] that most ovarian perforations are unrecognized examples of ovarian pregnancy, is not generally supported.

Fig. 1.—Photomicrograph of wall of perforated corpus luteum cyst showing dense, fibrinous layer between cavity and lutein layer (Case 8).

PATHOLOGY

The amount of free blood found in the peritoneal cavity after ovarian rupture may vary from one-half ounce to several liters. If the origin of the hemorrhage is a perforated graafian follicle only serosanguineous fluid may be present, but frank bleeding usually occurs when a richly vascularized corpus luteum ruptures. The reaction of the peritoneum itself is that of active hyperemia, the intensity of which varies with the degree of hemorrhage.

The ruptured portion of the ovary is usually adherent to the posterior surface of the uterus and exhibits a hemorrhagic excrescence of varying size. Following expression of the clot, the hematoma cavity presents a smooth, glistening interior of yellow hue. The latter is not pathognomonic of exposed lutein (corpus luteum) cells, and must not be employed as the criterion of identification. The yellow color may be de-

rived from lutein cells, lipoid deposits, blood pigment within phagocytes or luteinized theca interna cells (Teacher,[9] and Robinson[23]).

Histologically, the origin of the ovarian hematoma may be a graafian follicle, an atretic follicle cyst, a maturing corpus luteum or a corpus luteum cyst. The graafian follicle is distinguished by the membrana granulosa and the clumped, crowded cells of the theca interna. The atretic follicle cyst is recognized by the flattened or entirely atrophic

Fig. 2.—Photomicrograph of wall of perforated corpus luteum cyst showing marked alteration of the lutein cells (Case 7).

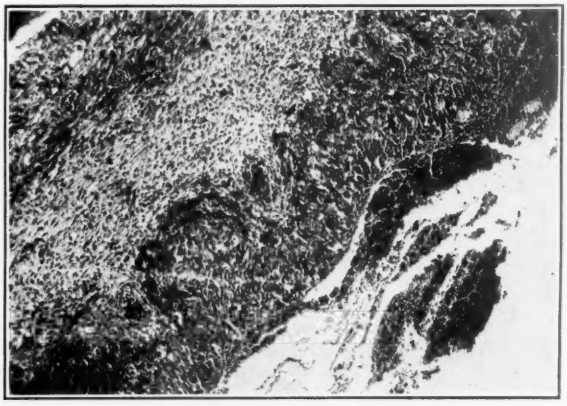

Fig. 3.—Photomicrograph of wall of perforated, mature corpus luteum showing part of the central hematoma, well-preserved lutein cells, interstitial hemorrhage, and V-shaped bands of theca interna (paralutein) cells (Case 1).

granulosa cells, and the well-preserved (often luteinized) theca interna cells. The maturing corpus luteum and the corpus luteum cyst are easily differentiated. The latter usually contains a firm, central hematoma which is separated by a dense, fibrinous layer (Fig. 1) from the unrecognizably altered lutein cells (Fig. 2). The mature corpus luteum is characterized by a loose, central hematoma and a layer of large, well-

preserved lutein cells. The appearance of the latter is modified by the newly formed capillaries, mild hemorrhage and the penetrating bands of paralutein cells (Fig. 3).

Inasmuch as dual lesions may occur, complete pathologic study should be made of all tissue removed during any laparotomy for ovarian rupture. Hematosalpinx (Greenhill[18]), ectopic pregnancy (Novak[2]), and acute appendicitis (Hoyt and Meigs[8]) have been reported in association with ovarian hemorrhage. One of our patients (Case 2) had an unruptured tubal pregnancy in addition to perforated corpus luteum. As shown by two patients of the present series (Cases 6 and 8), the excised appendix may show a definite inflammatory reaction of its outer layers (serosa and subserosa), in response to the irritation caused by free blood in the peritoneal cavity.

SIGNS AND SYMPTOMS

Ovarian rupture with intraperitoneal hemorrhage may occur at any time during the childbearing period, but it is more often seen in young women. The average age of several groups of patients reported recently[3, 7, 8] was no more than twenty-five years. Eight of the 10 patients herein reported were less than thirty years.

A characteristic relationship exists between the time of ovarian rupture and the menstrual cycle. Follicular rupture occurs at approximately mid-interval, and corpus luteum rupture during the last half of the cycle. As suggested by Pratt,[19] rupture of a graafian follicle with mild intraperitoneal hemorrhage may be the cause of mid-interval pain in certain women (Mittelschmerz). The time of corpus luteum rupture seems to be fairly constant, as illustrated by the fact that all 10 of the corpus luteum perforations presented below occurred during the premenstruum. This inherently functional relationship to the ovarian cycle is an important diagnostic feature and serves to distinguish between follicular and corpus luteum rupture.

The clinical manifestations of ovarian perforation may be either sthenic or asthenic, varying with the size of the perforation and the degree of hemorrhage. The patient with asthenic symptoms may appear quite comfortable, despite the considerable amount of free blood within the peritoneal cavity. The sthenic type, on the other hand, may be introduced by violent pain or shock. Between both extremes, all gradations of the acute abdomen may be present. The most prominent symptom is abdominal pain of sudden onset and variable intensity. It is more often localized in the right lower abdomen because of the more frequent involvement of the right ovary,[5, 7, 8] although right-sided pain may occur with left ovarian rupture (Block,[24] and cf. Cases 3 and 4). Nausea and vomiting are frequent accompaniments of the abdominal pain. Shoulder pain (referred) may appear if the free blood sufficiently irritates the subdiaphragmatic peritoneum. Shock may modify the entire clinical picture in fulminating cases.

Moderate elevation of the temperature and polymorphonuclear leucocytosis frequently occur, varying in degree with the amount of hemorrhage. The erythrocyte sedimentation rate may be abnormally rapid because of the intraperitoneal hemorrhage. Unfortunately, the febrile reaction, the leucocytosis, and the sedimentation test are not sufficiently characteristic to be of diagnostic significance.

Tenderness on palpation of the iliac fossae and rigidity of the recti muscles may be present, more especially of the right side. Bimanual examination may delineate the ovarian hematoma as a soft, tender adnexal tumor. Such a mass is differentiated from a tubal hematocele of ectopic pregnancy with great difficulty. The amount of free blood is rarely sufficient to cause bulging of the posterior culdesac, though it may occur (Case 8).

DIAGNOSIS

The view that preoperative diagnosis of ovarian hemorrhage is not possible, is no longer tenable. Many instances of correct preoperative diagnosis have been recorded despite a generally "low index of suspicion" (Stokes) for ovarian rupture. Evidence of the value of a "high index of suspicion" may be found in the creditable record of the staff of the Massachusetts General Hospital where 17 of 58 ovarian perforations were correctly diagnosed prior to operation (Hoyt and Meigs[8]). Inasmuch as there is no pathognomonic sign or symptom, the diagnosis of corpus luteum or follicle rupture must be based on a careful analysis of the history. Evaluation of the symptomatology in the light of its relationship either to the time of ovulation or to the premenstruum is of diagnostic value. Ovarian rupture with intraperitoneal hemorrhage should be suspected in any woman presenting an acute lower abdomen, during the latter half of her menstrual cycle. The clinical picture being that of any acute abdomen, mild or fulminating, requires differentiation from all major abdominal lesions. However, it most closely mimics acute appendicitis and ruptured tubal pregnancy.

The erroneous diagnosis of acute appendicitis is frequently proposed, more especially in follicular rupture. The sudden onset of abdominal pain, nausea, vomiting, fever, leucocytosis, and tenderness in the right iliac fossa characterizes both conditions. The erythrocyte sedimentation rate may be a diagnostic aid, inasmuch as it is usually normal in appendicitis (Lesser and Goldberger[25]) and increased by intraperitoneal hemorrhage. The presence of a palpable adnexal tumor favors the diagnosis of ovarian rupture. It may be virtually impossible to distinguish between acute appendicitis and ovarian rupture preoperatively. The attempt to accomplish this, however, should not be abandoned prematurely, because mild ovarian hemorrhage may not require surgical intervention. If reasonable doubt exists following an

exhaustive differential analysis, the diagnosis of appendicitis should be favored and a midline laparotomy performed.

The sthenic variety of ovarian rupture is usually diagnosed as ruptured ectopic (tubal) pregnancy. The presence of an adnexal tumor or culdesac bulging is not of differential value since it may exist in both conditions. The history is important, inasmuch as a preceding menstrual irregularity commonly occurs in ectopic pregnancy. In fulminating cases time should not be spent in establishing the exact diagnosis, because laparotomy is indicated in any case. However, if the clinical picture is mild and if a delay of from thirty-six to forty-eight hours is permitted by the patient's condition, the differential diagnosis may be aided by the Friedman pregnancy test. Since the test is relatively unreliable (32 per cent error) in ectopic pregnancy, only a *positive* reaction would be of diagnostic significance (Goldberger, Salmon and Frank[26]).

PROGNOSIS

The prognosis of ovarian rupture (nonpregnant) is good, varying proportionately with the degree of hemorrhage. Many mild cases are of minor gravity and pass entirely unrecognized. Isolated instances of death from massive ovarian hemorrhage have been reported (Novak[2]). The collective review of 77 cases by Johnson[15] in 1930, included 6 fatalities (7.8 per cent). No deaths occurred in the series more recently reported.[4-8]

TREATMENT

The advisability of operation depends upon the individual case. If appendicitis or ectopic pregnancy can be definitely excluded from the diagnosis, nonoperative treatment may be applicable in many instances of ovarian hemorrhage (Pratt[19]). In order to obviate the possibility of erroneous diagnosis, careful observation is the sine qua non of nonoperative therapy. Thus, if there is any doubt concerning the existence of a more serious lesion (appendicitis or ectopic pregnancy), laparotomy is indicated.

The patients exhibiting signs of marked hemorrhage require immediate operation. If shock is present, supportive measures (including blood transfusion, intravenous infusion of glucose solution, and external heat) are necessary adjuvants. The incision should be lower midline or paramedian. Whenever possible, the bleeding ovary should be conserved. The simplest procedure is to strip the hematoma cavity of its lining and approximate its walls with a fine catgut suture. Wedge-shaped resection of the ovary or oophorectomy may be required, if the bleeding is uncontrollable with sutures. The treatment required by any concomitant pelvic pathology should be performed, if the patient's condition warrants.

REPORT OF CASES*

The histories of ten patients are briefly recorded below. A summary of the more pertinent data appears in Table I.

CASE 1.—(Mount Sinai Hospital, No. 91489.) The first patient, B. M., aged twenty-five years, who had had menses of the type, 12 × 30 × 4, reported that her last period had begun March 20, 1935. On April 19, 1935, she was seized with pain in lower abdomen and was nauseated. Her temperature was found to be 99.3° F., and her leucocyte count, 11,800. Examination showed a walnut-sized, cystic mass to the right of the uterus. At laparotomy free blood was found in the peritoneal cavity and a ruptured right ovary was adherent to the posterior uterine wall. An ovarian hematoma was resected and bleeding controlled by mattress suture. The pathologic report was hemorrhagic corpus luteum in the stage of vascularization (Fig. 3).

CASE 2.—(Mount Sinai Hospital, No. 61265.) R. B., aged thirty years, had had menses of the type 14 × 28 × 5, but her last period on Jan. 5, 1931, had been scanty. On Jan. 12, 1931, she developed pain in the right lower abdomen with nausea and vomiting, but the temperature was normal and the leucocyte count only 10,200. Examination disclosed a tender, right adnexal tumor, the size of a hen's egg. Laparotomy disclosed an unruptured ectopic pregnancy in the right tubal isthmus, old blood in the posterior culdesac, and a firm clot protruding from the interior of the right ovary. Right salpingo-oophorectomy was performed. A pathologic report of hemorrhagic, mature corpus luteum and tubal pregnancy was made.

CASE 3.—(Mount Sinai Hospital, No. 61032.) Y. A., aged twenty-five years, with former menses of the type 15 × 30 × 4, had had her last menstrual period on Dec. 6, 1930. On Dec. 18, 1930, pain began in the right lower abdomen, the temperature remained normal but the leucocyte count rose to 14,050. Examination revealed only tenderness in the right iliac fossa. At laparotomy the peritoneal cavity was found "filled with blood" and the left ovary bleeding actively, the latter being controlled by a running suture.

CASE 4.—(Mount Sinai Hospital, No. 49343.) M. R., aged twenty-one years, with menses of the type, 11 × 28 × 4, had had her last period on Sept. 1, 1928. On September 22, pain developed in the right lower abdomen with nausea and vomiting, the temperature being 99.2° F., and the leucocyte count 24,000. Examination showed only McBurney point tenderness. Laparotomy disclosed serosanguineous fluid in the peritoneal cavity and a perforated left ovary. Left salpingo-oophorectomy was performed, the pathologic report being hemorrhagic, mature corpus luteum.

CASE 5.—(Mount Sinai Hospital, No. 50032.) H. R., aged twenty-two years, reported menses of the type 12 × 30 × 5 and a last period on Oct. 29, 1928. On November 24, pain began in the right lower abdomen accompanied by nausea and vomiting. The temperature was 100° F., and the leucocyte count 8,000. Examination showed a right adnexal mass, hen's egg in size. Laparotomy disclosed a serosanguineous fluid in the posterior culdesac and a bleeding perforation of the right ovary. The ovarian perforation was closed by a single mattress suture.

CASE 6.—(Mount Sinai Hospital, No. 94663.) E. B. G., aged sixteen years, had had menses of the type 11 × 30 × 3 and had menstruated last on Aug. 17, 1935. On September 8, pain began in the right lower abdomen, the temperature rose to 99.4° F., and the leucocyte count to 15,900. Examination showed only McBurney point tenderness. At laparotomy fresh blood was found in the posterior culdesac with a ruptured hematoma of the right ovary and a small, right parovarian cyst. Ap-

*Eight were collected from the surgical and gynecologic records of the Mount Sinai Hospital of the past ten years, and 2 from the gynecologic records of the Hospital of the University of Pennsylvania of the past five years.

pendectomy, excision of the parovarian cyst and ovarian resection were performed. The pathologic report was serosal and subserosal inflammatory process of the appendix (mucosa and muscle layer not involved), and mature corpus luteum.

CASE 7.—(Mount Sinai Hospital, No. 50403.) I. Y., aged twenty-two years, reported menses of the type, 14 × 35-40 × 5 with her last period on Dec. 9, 1928. On January 13, pain began in the right lower abdomen with nausea and the temperature was found to be 99.3° F., the leucocyte count 24,000. Examination revealed a lime-sized, right adnexal mass. At laparotomy several blood clots were found in the posterior culdesac and an oozing rupture of the right ovary. A wedge-shaped ovarian resection was performed. The pathologic report was simply corpus luteum cyst (Fig. 2).

CASE 8.—(Mount Sinai Hospital, No. 40479.) K. S., aged thirty-four years, with menses of the type 13 × 28 × 3, had had her last period on May 1, 1926. On May 18, 1926, abdominal pain set in with nausea and vomiting. A temperature of 96.5° F., and a leucocyte count of 9,400 were noted. Shock, restlessness, air hunger, a board-like lower abdomen and bulging of the posterior culdesac were present. At laparotomy the peritoneal cavity was found "filled with blood," the left ovary bleeding from a large perforation. Left salpingo-oophorectomy and appendectomy were performed. The pathologic report was serosal and subserosal inflammatory reaction of the appendix and tube and corpus luteum cyst (Fig. 1).

CASE 9.—(Hospital of the University of Pennsylvania, Gyn. No. 22835.) P. W., aged twenty-seven years, with menses of the type 12 × 28 × 5, had had her last menstrual period on June 13, 1933. On July 12, pain began in the left lower abdomen, with vomiting, but the temperature was normal and the leucocyte count only 11,600. Examination disclosed a small, tender left adxenal mass. At laparotomy, there was found free blood in the posterior culdesac and a large, bleeding rent in the left ovary. The hematoma was stripped out and the rent was closed with sutures. The pathologic report was hemorrhagic corpus luteum cyst.

CASE 10.—(Hospital of the University of Pennsylvania, Gyn. No. 23202.) H. B., aged forty-three years, with menses of the type 12 × 28 × 3, had had her last period on October 14, 1933. On October 30, she was seized with pain in the lower abdomen but the temperature remained normal and the leucocyte count was only 8,000. A pelvic mass of grapefruit size, probably the uterus, was noted on examination at laparotomy. A free blood was found in the peritoneal cavity with several

TABLE I. ANALYSIS OF TEN PATIENTS WITH INTRAPERITONEAL HEMORRHAGE FROM CORPUS LUTEUM RUPTURE

PATIENT	AGE	RELATIONSHIP TO MENSES		ACTION WHEN RUPTURE OCCURRED	ADMISSION LEUCOCYTE COUNT	DIAGNOSIS PREOPERATIVE
		LENGTH OF CYCLE (DAYS)	DAY OF RUPTURE			
1	25	30	29	Coitus	11,800	Tubal abortion
2*	30	28	Menstruating	Walking	10,200	Tubal abortion
3	25	30	13	Dancing	14,050	Acute appendix
4	21	28	21	Typing	24,000	Acute appendix
5	22	30	25	Walking	8,000	Acute appendix
6	16	30	22	Playing tennis	15,900	Acute appendix
7	22	35-40	34	Eating	24,000	Acute appendix
8	34	28	18	Sleeping	9,400	Ruptured ectopic
9	27	28	27	Playing bridge	11,600	Tubal abortion
10†	43	28	16	Riding in auto	8,000	Myoma uteri

*Unruptured tubal (isthmic) pregnancy also present.
†Myoma uteri also present.

myomata uteri, and a ruptured hematoma of the left ovary. Supravaginal hysterectomy and left salpingo-oophorectomy were performed. The pathologic report was fibromyomas of the uterus and hemorrhage corpus luteum cyst.

SUMMARY

1. The clinical and pathologic features of ovarian rupture (nongravid) are presented. Corpus luteum perforation is shown to be a more frequent cause of intraperitoneal hemorrhage than is follicular rupture.

2. The characteristic relationship between the time of ovarian rupture and the menstrual cycle is described. Follicular perforations occur at mid-interval and those of the corpus luteum during the latter half of the menstrual cycle.

3. The differential diagnosis between ovarian rupture, acute appendicitis, and ectopic pregnancy is discussed.

4. The treatment of ovarian rupture is usually laparotomy with conservation of the bleeding ovary. Nonsurgical treatment may be permitted if the diagnosis is certain.

5. Ten cases of corpus luteum rupture with intraperitoneal hemorrhage are reported.

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2116 Spruce Street

Villard: A New Case of Pregnancy Following a Salpingostomy, Bull. Soc. d'obst. et de gynéc. **25:** 305, 1936.

The author reports the fifth case in his personal series of salpingostomies where a pregnancy followed this operation. Two of the women had abortions but another one who first had a miscarriage subsequently had three children at full term.

J. P. Greenhill.

EVALUATION OF SALPINGOSTOMY AND TUBAL IMPLANTATION FOR THE TREATMENT OF STERILITY*

J. P. GREENHILL, M.D., CHICAGO, ILL.

DURING the last few years great interest has been shown in operations on the fallopian tubes to overcome sterility. Obstructions in the tube are usually located at the fimbriated end or at the cornual end, but the closure may be present only in the midportion or in combination with other areas of obstruction. The types of operation generally performed to correct complete tubal closure are as follows:

When the occlusion is at the fimbriated end, simple release of adhesions may suffice to restore the patency of the tube (salpingolysis). More frequently, however, the distal portion of the tube must be removed or incised, and in one of many ways a permanent opening is made (salpingostomy). When an obstruction exists only in the midportion it is best to remove the site of obstruction together with the distal portion of the tube and perform a salpingostomy on the proximal portion. This is simpler than removing that portion of the tube containing the obstruction and suturing the incised ends in apposition. If the obstruction is in the uterine end of the tube, the operation generally performed consists of the removal of the cornual part of the tube together with a portion of the uterine corner and implantation of the distal, normal tube into the uterine cavity (tubal implantation). A second way to treat tubal obstruction situated at the cornual end is to remove the entire tube and implant half of the corresponding ovary still attached to its pedicle on the cornua (Estes operation). A third operative procedure to overcome obstruction at the cornua consists of the removal of the tube and implantation of the entire ovary inside the uterine cavity (Tuffier operation). In this paper, however, we are concerned chiefly with salpingostomy and tubal implantation.

SALPINGOSTOMY

Nearly every author who refers to the historical aspect of this operation makes the statement that the first salpingostomy was performed by A. Martin in 1885. However, Isbruch maintains that A. Martin and Schroeder performed this operation independently at the same time.

A. Mackenrodt reported two successful cases in 1894. From 1885 to 1895 Martin performed 62 salpingostomies. He followed 47 of these patients but only two became pregnant after the operation. In 1911, Gellhorn reported a successful case

*Read at a meeting of the Chicago Gynecological Society, May 8, 1936.

and mentioned that the literature of Germany, France and America contained 13 other cases of equally good results. In the discussion of this paper Bovée mentioned that he had done several salpingostomies, but that only one pregnancy occurred, which was an ectopic. In 1919, Bullard reported 3 pregnancies after 44 operations and in 1920, Seitz observed two abortions after 22 operations. In 1922, Child reported that he had observed 8 full-term babies after 7 plastic operations on the tubes and Ritter reported 65 salpingostomies with 4 subsequent pregnancies. Only one of the latter gestations went to term, 2 ended as abortions, and one was an ectopic pregnancy. Unterberger reported 5 full-term pregnancies after 57 salpingostomies, and Isbruch delivered 3 babies after 14 operations. Fuchs followed up 34 out of 42 women who had salpingostomies and found that only two pregnancies supervened. One was an intrauterine and the other an extrauterine gestation. Solomons performed 25 resections of the fimbriated end of the tube which were succeeded by 6 pregnancies. He also performed 15 resections of the isthmus, following which he observed one uterine pregnancy and two tubal gestations. In a later article (1935) Solomons reported 28 pregnancies after 366 tubal operations, the largest number performed by a single individual. The 28 pregnancies occurred after the following types of operation: 18 resections at the fimbriated end, 4 resections at the isthmus and 6 resections at the interstitial part. In addition to the 28 uterine gestations there were two ectopic pregnancies, both after isthmial resections. The total incidence of pregnancy, therefore, in the 366 cases, was 8.2 per cent. In the discussion of this paper Meaker reported 10 pregnancies after 19 salpingostomies. One of these gestations was an ectopic.

Koenig reported one pregnancy following 20 salpingostomies and Paucot had one intrauterine and one ectopic pregnancy. Similarly, Stockaert encountered one tubal pregnancy. Geller performed 21 salpingostomies, with negative results; Fels failed to observe any pregnancies after 34 such operations. Topuse claimed successful results in 15 per cent of his cases of salpingostomy (number not stated), and Matwejewa observed 5 full-term gestations after 45 salpingostomies. Haselhorst failed to observe a single pregnancy after 55 of these operations, but Coghlan reported 3 pregnancies after 17 salpingostomies.

Kerwin and Gellhorn performed 50 salpingostomies. Of the 28 women followed, 7 conceived (25 per cent). One of these pregnancies was an ectopic and one terminated in an abortion. In the discussion of this paper Polak mentioned that he had performed 51 salpingostomies, with ultimate success in 7 patients bearing 10 babies.

Schmitz performed 15 salpingostomies, 2 of which were followed by pregnancy. This author collected a series of 429 cases in which 43 full-term pregnancies (10 per cent) occurred.

Dworzak and Hajek reported 78 salpingostomies, and 52 of these patients were followed. Only one pregnancy took place, which was an ectopic. The patient died on the operating table. Schultze observed 10 pregnancies in a series of 150 plastic operations performed by himself and others. In his series of 600 cases of sterility the tubes were closed in 44 per cent. Pregnancy, however, occurred in 3 per cent of these cases and in only 6 per cent when surgery was performed on the tubes.

Von Graff recently (1936) collected a series of 568 salpingostomies and tubal plastic operations from the literature after which he found 60 pregnancies (10.5 per cent). Among these 60 pregnancies, 16 went to term, 33 ended in abortion, 5 were ectopic and in 6 cases the outcome was unknown. Hence, there were only 16 known full-term babies after 568 operations, an incidence of 2.8 per cent or one baby for every 35.5 operations. Von Graff's incidence of ectopic pregnancies is far too low, as may be gleaned from my discussion of the complications which occasionally follow salpingostomy (see below). Sixteen ectopic gestations following this opera-

tion, excluding Von Graff's own case, are listed. The names of authors are not mentioned in Von Graff's article, hence it is difficult to ascertain the individual sources of his statistics. Since he appends an extensive and accurate bibliography to his paper it is unfortunate that many ectopic pregnancies were overlooked in his review.

COMPLICATIONS AFTER SALPINGOSTOMY

The complications which have arisen following salpingostomy are as follows:

1. The mortality most likely has not been greater than for simple laparotomies, but a few opponents of plastic operations on the tubes maintain there is no justification for exposing any woman to the risk of a laparotomy simply to overcome sterility.

2. The postoperative morbidity is difficult to judge, but a few authors have noted a high frequency of febrile complications. Thus Fuchs reports that in spite of the great care exercised in the selection of his cases he observed that febrile adnexal inflammation occurred after salpingostomy in 16 per cent of them. Dworzak and Hajek state that peritonitis following salpingostomy occurs in many cases because there is no way to ascertain whether or not the tubal contents are sterile. A. Martin had two deaths from peritonitis. Odebrecht, Veit and Prochownik reported reactivation of infection with the formation of pyosalpinx in the tubes upon which plastic operations had been performed. These patients required another laparotomy for removal of the inflamed adnexa. Dworzak and Hajek believe that such infections occur much more frequently after salpingostomies than the reports in the literature indicate. In many instances, however, I feel certain the cases were not suitable for this type of operation. For example, histologic examination revealed that 7 of Ritter's 65 cases had tuberculous salpingitis and therefore, plastic operations should not have been performed in these patients. Only one of them became pregnant, resulting in an abortion.

3. Abortion has occurred frequently after salpingostomy. A number of factors may be responsible for this, but perhaps two important ones are the following: (a) The functioning portion of the tube which is left after operation is shorter than the normal tube, and it may be that the fertilized ovum reaches the uterine cavity before it has completely arrived at the proper stage for implantation in the uterine endometrium. (b) The condition which produced the closure of the tubes may be responsible also for the abortion.

4. Ectopic pregnancies have occurred with relatively great frequency. It is difficult to determine exactly how many salpingostomies have been performed throughout the world because by no means have all of them been reported. Furthermore, there are many brief reports in the literature of one or more successful cases observed by individual gynecologists, but the negative results rarely have been published, except from large clinics. Seventeen ectopic pregnancies have been reported in the literature by the following 16 authors, but, as the answers to the questionnaire indicate, there have been others: Bovée, Duffek, Dworzak and Hajek, Fraenkel, Fuchs, Von Graff, Glitsch, Kerwin, Meaker, Paucot, Prochownik, Ritter, Solomons (2), Stockaert, Tweedy and Wesenberg.

The cause of ectopic pregnancies following plastic operations on the tubes is not known. Mechanical obstruction in the region of the operation most likely is not a frequent cause. Complete closure, of course, prevents passage of the spermatozoa; but if there is an opening sufficiently large to permit fertilization the ovum can nearly always pass through to enter the uterus. Interference with normal tubal peristalsis as a result of the original disease or because of adhesions may be a cause. Likewise changes in the tubal mucosa brought about by the disease which was originally responsible for the tubal closure may be the cause of some of these ectopic pregnancies. However, an important factor in producing ectopic gestations is the predisposition to recurrence of ectopic pregnancies in some women. As is well

known, a definite proportion of women have a second tubal pregnancy in the presumably normal tube which is left behind. A fair number of the reported salpingostomies were performed on the remaining tube at the time an ectopic pregnancy was removed. Many of these plastic operations have enabled women to give birth normally but, on the other hand, a few of them have been followed by repeated tubal pregnancies. In some of these women the second tubal pregnancy probably would have occurred even if the plastic operation had not been done.

5. Other late disturbances may occur after salpingostomy. Dworzak and Hajek found that 75 per cent of the 51 patients on whom they had performed salpingostomies subsequently complained of pain, especially at the time of the menses. Eleven of these women developed masses in the adnexal region, one of which was found to be a pelvic abscess, and another proved to be a large tuboovarian cyst.

TUBAL IMPLANTATION

The first tubal implantation was performed by T. Watkins in 1896 (not 1897 as generally stated in the literature), on a patient who had previously had one tube removed and who had an adenomyoma in the isthmus of the remaining tube. Permeability of the tube was restored. A few months later the patient had a miscarriage. This case was reported by both Watkins and E. Ries. No mention was again made in the literature of a tubal implantation until 1921.

In that year Shaw reported a successful tubal implantation performed by Cullen. (It was my good fortune to see this patient in the Johns Hopkins Hospital Dispensary, and also to assist Doctors Cullen and Shaw at the operation.) The patient had a placenta previa at seven and one-half months. However, a year later Cullen reported on the same patient because she had given birth to a full-term child. This was the first case in which a living child was born after transplantation of a tube. The first tubal implantation in Europe was performed by A. Mayer in 1917 but he did not report the case until 1924. Other reports of this operation appeared in the literature in rapid succession by Phillips, Volkmann, Novak, Strassmann, Unterberger, Kiparsky, Mandelstamm, Cotte and Bertrand, Douay, Markoff, Pfeilsticker, Michaelis, Heuck, Szekely, Melinkow, Black, Fels, Kattermann, L. Fraenkel, Redenz, Heimann, Tavernier and Gonnet, Dauve, Béclère, Von Graff, R. E. Watkins, Geyer, and Zimmermann. The pregnancy which Unterberger reported in 1925 was the first one reported in Europe following tubal implantation. The second successful outcome in Europe was the one reported by Mandelstamm.

In 1932, Reiprich collected 40 tubal implantations from the literature following which there were 6 pregnancies. However, in 1930 Markoff had found reports of 54 such operations with 9 pregnancies, of which 6 went to term and one was an ectopic. He himself performed 4 operations and observed one pregnancy. Bonnet, in 1933, reported that in the literature up to this time he had found only ten pregnancies which had gone to term, one premature labor at seven and one-half months (Shaw) and one ectopic pregnancy (Heuck). In 1934, Fels reported 4 tubal implantations performed in his clinic. Only one pregnancy resulted and this was intrauterine. However, labor terminated in a rupture of the uterus at the site of the tubal implantation after a spontaneous delivery. Fels attributed this accident to the fact that the patient became pregnant too soon after the operation. In one case (Unterberger) the patient became pregnant one month after operation.

A large series of tubal implantations performed by one individual was first reported by B. Solomons in 1927. Up to this time he had done 24 of these

operations. He was rewarded with 3 pregnancies, 2 of which went to term and one ended in abortion. In 1935, Solomons reported 6 pregnancies following tubal implantations. (The total number of these operations is not stated.) C. C. Norris obtained excellent results in his series of 8 plastic operations on the tubes. Three full-term pregnancies followed tubal implantation and another full-term baby was delivered after a salpingostomy. Geyer had one full-term pregnancy after 5 tubal implantations.

Heuck performed 7 tubal implantations which were followed by one full-term pregnancy and one tubal pregnancy. Brunner observed an ectopic gestation following tubal implantation, and Dawson reported the following interesting case of a woman who had had 4 ectopic pregnancies. After an ovum was removed from the left tube, a salpingostomy was performed on both tubes. Three years later the patient had an ectopic pregnancy in the right tube and after two more years she had a third ectopic gestation, this time in the left tube. Both salpingostomy openings were dilated. Nine years after this, another operation was performed for a fourth ectopic pregnancy, again in the left tube.

Von Graff recently reported 2 tubal implantations, the first of which was followed by the delivery of a full-term baby, but the second patient had a tubal pregnancy. In Von Graff's review (1936) he collected 70 tubal implantations, of which 26 were followed by pregnancies. In 23 instances the pregnancy went to term, one ended prematurely as a stillbirth, one terminated as an abortion, and one was an ectopic. This yields a total of 23 full-term babies after 70 tubal implantations, an incidence of 32.9 per cent. In view of the results of the authors quoted above, it is difficult to believe that this figure represents the true incidence of full-term pregnancies after tubal implantation. In the first place, many gynecologists have preformed salpingostomies and tubal implantations, but they have not reported their cases because they have had no success with these operations. Thus, in the discussion of Solomons' paper before the Sixth British Congress of Obstetrics and Gynaecology, Sir Ewen Maclean said: "I have many times performed salpingostomy in cases of salpingitis with sealing but I cannot quote to this Conference any instance in which there has been a succeeding pregnancy." In the second place, it is certain that more than one ectopic pregnancy has been reported after tubal implantation. I have found reports of three ectopic pregnancies after tubal implantation (Heuck, Brunner, Dawson) besides the one reported by Von Graff himself.

COMPLICATIONS AFTER TUBAL IMPLANTATION

The same complications which followed salpingostomies have occurred after tubal implantation, namely, slight mortality, postoperative febrile complications, abortion, ectopic pregnancy, and late disturbances. To these should be added rupture of the uterus at the site of the tubal implantation (Fels' case).

RESULTS OF A QUESTIONNAIRE

In order to determine the sentiment of American obstetricians and gynecologists concerning salpingostomies and tubal implantations, a questionnaire was sent to the members of the American Gynecological Society and the American Association of Obstetricians, Gynecologists and Abdominal Surgeons. One hundred and seven replies were received.

The questions and a summary of the answers are as follows: (Table I.)

1. Number of salpingostomies performed.

Of the 107 individuals who answered, 53 (50 per cent) had never performed any salpingostomies. Of the remaining 54 who replied, 14 said they had done "a few" of these operations, 5 had done "many" and 40 reported from one to 173 salpingostomies.

2. Number of tubal implantations performed.

Eighty-eight of the 107 individuals (82.2 per cent) answered that they had never performed a single tubal implantation. Of the remaining 19, five had done "a few," one had done "many," four had done one operation, three had done 2 tubal implantations and one each had performed 3, 5, 10, 15, and 18 of these operations, respectively.

3. Were Rubin tests or lipiodol injections made after operation to prove patency?

Most of the answers indicated that Rubin tests and salpingograms had not been employed, but many of the operations had been performed a number of years before these diagnostic tests were introduced. In many instances the reconstructed tubes were found to be closed by the Rubin test or salpingography, and in other cases the tubes were patent but no pregnancies followed. When more than one salpingostomy was performed the highest incidence of tubal patency following operation was 75 per cent in "several" cases. In one series of 9 cases all the tubes were closed after operation.

4. Did any pregnancies follow operation?

a. Went to or near term.
b. Ended in abortion.
c. Ectopic pregnancy.

Altogether 54 pregnancies were reported in the questionnaires. Of this number 10, or 18.5 per cent, ended in abortion; 8, or 14.8 per cent, were ectopic pregnancies, and 36, or 66.7 per cent, resulted in live babies. Among these 36 babies four previously reported by Norris are included. The number of salpingostomies specifically reported in the questionnaires was 521. In addition to this, 14 individuals stated that they had done "a few" and six stated that they had done "many" of these operations. If we arbitrarily consider 5 operations as "a few" and 20 as "many" we have 190 more salpingostomies to add to the 521 where the numbers were specifically stated. Hence, there was a total of about 711 salpingostomies. In addition to this, the specific number of tubal implantations reported in the questionnaires was 62. Five individuals stated they had done "a few" and one said he had done "many." Arbitrarily using 5 and 20, respectively, for the "few" and "many" we have a total of about 107 tubal implantations. Hence, the number of all plastic operations reported was 711 plus 107, or 818. Since 54 pregnancies of all types followed these operations, the incidence of both normal and abnormal pregnancy was 6.6 per cent, or one pregnancy for every 15 plastic operations. However, since there were only 36 live babies in the entire series, the incidence of live babies was 4.4 per cent, or one live baby for every 22.5 operations.

Some of the individuals obtained excellent results, as for example, Curtis and Gardner, who reported "about seven" babies after 12 salpingostomies and C. C. Norris who delivered 4 live babies after 10 tubal implantations and a few salpingostomies. Cullen operated upon one patient who had three children and a fourth pregnancy in short succession after a plastic operation and another patient who

had two children promptly after operation. However, others had very little success. Thus Litzenberg reports one live baby after about 25 operations, Cooke (and Lee) three pregnancies after 173 operations, Dickinson no pregnancy following 30 operations, and Bland not a single pregnancy after "100 or more" of these operations. Living babies were reported by Cooke, Cullen, Curtis and Gardner, Dieckmann, Douglas, Gellhorn (through Emmert), Greenhill, Holden, Litzenberg, Matthews, Newell, Norris, Rongy, Royston, Schmitz and Wynne. The ectopic pregnancies were reported by Dannreuther, Gellhorn, Greenhill (see case report), Matthews, McGlinn, Royston (2), and Sampson. Information of three additional ectopic pregnancies has been received from Sovak and Meaker.

5. If the pregnancy went to viability, how was the baby delivered?

Of the 36 babies, 24 were presumably delivered spontaneously, 11 by low forceps and one by cesarean section.

6. Did any complications follow the operation?

Two deaths from peritonitis and one pelvic infection were reported.

7. Do you believe salpingostomies and tubal implantations are useful operations? If not, why not?

Among the 107 questionnaires, 60 (56 per cent) opinions were definitely opposed to these operations, 19 (18 per cent) were distinctly in favor of them, 16 (15 per cent) said the operations were worth while occasionally, and 12 (11 per cent) expressed no opinion. The group of 60 men who opposed the operations consisted both of individuals who had performed these operations and those who had not. On the other hand, some of the 19 who were definitely in favor of the operations had never done one, in spite of the belief they expressed. Many of the men who either expressed no opinion or said the operations occasionally had a field of usefulness had never performed any of the operations themselves. Hence, in spite of the fact that these men were all specialists in obstetrics and/or gynecology, they were not enthusiastic enough to try these operations even once. The expressed and implied sentiment, therefore, of the majority of those who answered the questionnaires is that plastic operations on the tubes to overcome sterility are not worth while.

TABLE I

Number of replies	107		
Never performed salpingostomies	53	(50%)	
Never performed tubal implantations	88	(82.2%)	
* * * * *			
Number of salpingostomies performed	711		
Number of tubal implantations performed	107		
Total operations	818		
Total pregnancies	54	(6.6%)	
(One pregnancy for every 15 operations)			
Total live babies	36	(4.4%)	
(One baby for every 22.5 operations)			
Babies	36	(66.7%)	Of 54 pregnancies
Abortions	10	(18.5%)	Of 54 pregnancies
Ectopic pregnancies	8	(14.8%)	Of 54 pregnancies
* * * * *			
Number of individuals against plastic operations	60	(56%)	
Number of individuals for plastic operations	19	(18%)	
Number who believe operations are sometimes worth while	16	(15%)	
Number who did not express any opinion	12	(11%)	

In contrast to the results elicited in the questionnaire is the information obtained from Meaker and Sovak who were not on the membership lists for the questionnaires but to whom I wrote personally because of their interest in the subject. Meaker has performed 22 salpingostomies but no tubal implantations, and he observed 11 subsequent pregnancies, of which two were ectopics. One woman had two babies. Sovak and Holden reported improved plastic operations on the tubes, and the results of Sovak's cases are as follows: After five operations (3 salpingostomies and 2 tubal implantations) on private patients, three pregnancies (60 per cent) followed, but one of these was an ectopic. The other two resulted in live babies. Among 30 clinic patients operated upon (22 salpingostomies and 8 tubal implantations) pregnancy occurred in 3 (30 per cent) of the first 10.

OVARIAN IMPLANTATION

Some gynecologists who are opposed to tubal implantation remove the entire tube with the uterine corner and implant a portion of an ovary on the exposed portion of the uterus. A few gynecologists transplant the ovary into the uterine cavity.

Von Graff collected 66 cases in which a graft of ovarian tissue was placed on a uterine horn or on a tubal stump. He reported 14 pregnancies (21.2 per cent) following these operations. However, since only 5 of these pregnancies went to term, only 7.6 per cent of the operations, or 1 in 13.2 operations, resulted in a full-term baby. Among the remaining 9 gestations, there were 6 abortions and one ectopic pregnancy. The outcome in 2 cases was unknown. In Von Graff's collected series of 41 cases in which an ovary was transplanted into the uterine cavity, only 3 pregnancies (7.5 per cent) resulted, of which one went to term (2.4 per cent) and the other two ended in abortion. Reiprich collected 200 ovarian transplants of all types and reported only 5 pregnancies (2.5 per cent) following these operations. Estes followed up 27 out of 88 patients on whom he had performed his ovarian transplantation operation and found that pregnancy had occurred in 4 of them (15 per cent). In a later article, Estes reported that in a series of 50 patients whose case records were complete, only 4 became pregnant (8 per cent). Two of these women had abortions and two had full-term babies.

Sovak states (personal communication) that four pregnancies resulted after the six Estes operations he had performed. Because of economic conditions three of these women had induced abortions but the fourth patient had a spontaneous abortion.

Some of the complications which I have described as having followed plastic operations on the tubes have also occurred after ovarian transplantation. Thus R. E. Watkins performed an ovarian transplantation and subsequently had to do another operation to remove the transplanted ovary which had grown to be a cystic mass 9 cm. in diameter, and which proved to be a chocolate cyst. Wier reported a death following an ovarian transplantation. This woman became pregnant following an ovarian graft but her uterus ruptured during labor. Autopsy revealed that the rupture had occurred at the site of the ovarian transplantation.

In a personal communication Mathieu described a case in which he removed a fallopian tube, made an opening in the cornu, and sutured an ovary into the uterus at this point. The patient became pregnant. Fearing that a rupture of the uterus might take place, Mathieu performed a cesarean section and found the transplanted ovary in the same position but flattened out like a pancake and about 8 cm. in diameter. He was able to insert five fingers through this thin ovary into the uterine cavity. Hence his fears concerning a rupture of the uterus were well substantiated.

COMMENT

A great variety of opinions were expressed in the questionnaires. Most of the replies condemned both salpingostomy and tubal implantation, but some approved of both. A few individuals favored salpingostomy and condemned tubal implantations, while others expressed themselves vice versa. The following are representative opinions expressed in answer to question No. 7: "Do you believe salpingostomies and tubal implantations are useful operations? If not, why not?"

Aldridge—". . . any technic which restores patency has value from two standpoints. There is always the possibility of pregnancy and the patient's hope for a pregnancy is restored—which forestalled an imminent divorce in the case reported. . . ."

Bland—"Very little value" (Bland has performed more than 100 salpingostomies and 5 or 6 tubal implantations).

Cooke—"A justifiable operation if desire for pregnancy justifies risk, disability and expense of operation in face of rather long odds against success."

DeLee—"My own experience is small and discouraging, but I believe the operations are worth discussing and occasionally deserve practicing."

Dickinson—"Salpingostomy has successes too infrequent to warrant laparotomy for cure of sterility. I checked on Polak's large series and while he at one time advocated it, he later condemned it as useless. Tubal implantation is much more promising."

Frank, R. T.—"Most closures of tubes are due to inflammation. After operation the inflammatory process recloses the tubes."

Farrar—"Yes, decidedly."

Gellhorn (reported by Emmert)—"It is, after all, a matter of individual judgment whether or not the tube appears to be in good condition capable of restoration of function."

Holden—"Yes, if male and female are found to be otherwise normal and if done by a technic similar to that of Sovak."

Kennedy, J. W.—"I can answer in the negative as I feel many of these operations will fail, pregnancy will rarely follow and many patients will return for a second operation."

Litzenberg—"Yes, because they occasionally result in pregnancies. My one success makes me believe it worth while to have done the many unsuccessful operations."

McGlinn—"I am not justified in view of the various risks and the slight possibility of success in urging the operation to be done."

Masson—"I practically never advise the operation and only do it when the patient insists on something of the kind being done."

Mathieu—"I am terribly skeptical about the success of salpingostomy and tubal implantations."

Matthews—"They should really be used more often than they are—which I believe is due to the inability of most operators to perform these operations in a satisfactory manner."

Meaker—"I do not consider that tubal implantation is a justifiable procedure. I believe that salpingostomy is warranted."

Nicholson—"Possibly useful but results reported have been so uncertain that I have not been interested in the subject."

Norris—"Yes, in a certain small group of cases, I believe they may have a place in the treatment of sterility."

Phaneuf—"I personally advise against operation if the decision is left to me."

Rongy—"Spontaneous resolution is likely to take place in a greater number of cases without any operative interference—a negative result after an operation means permanent sterility."

Schmitz—"These operations are justifiable when the patient insists on having offspring, if possible."

CASE REPORT

A case in which I performed both a salpingostomy and a tubal implantation is cited below. The patient subsequently became pregnant twice, once in the uterus and the second time in the implanted tube.

Mrs. F. K., aged twenty-six years, was referred to me by Dr. B. Turman because of sterility. She had been married seven and a half years and had never been pregnant. The husband's semen had been found to be normal. The patient's past history presented nothing abnormal and the menstrual cycle had always been fairly regular and normal. The patient was short and thin. Her general examination and Wassermann reaction were negative. On bimanual examination it was found that there was a normal marital outlet, the cervix was smooth and clean, the fundus was normal in size, hard, anteflexed and movable, the left adnexa felt normal but the right ovary was slightly but definitely enlarged and cystic. A Rubin tubal patency test was performed but the tubes were found to be closed. Two days later hysterography was done, using lipiodol. Fluoroscopic and x-ray examinations revealed a hydrosalpinx on the right side, with numerous beads of lipiodol inside the right tube. The tube on the left side was blocked at the cornual end. The condition was explained to the patient, but she had previously heard a good deal about operations on the tubes and wanted such an operation performed. On Nov. 23, 1932, she was operated upon at the Woodlawn Hospital. Because of the hydrosalpinx on the right side, the distal two-thirds of this tube were removed, the proximal one-third incised almost its entire length, and the tubal mucosa of this portion sewed to the serosa with interrupted fine catgut. Air was blown through the opening thus made into the uterine cavity with a Luer syringe, proving that this small tube was patent. There was a block at the uterotubal junction on the left side. This area with almost one-half of the proximal part of the tube was removed. The distal portion of the tube was then implanted into the uterine corner in the manner of implanting a ureter into the bladder. Air blown through this newly made opening into the uterus went through very easily. The right ovary was found to consist almost entirely of a chocolate cyst. It was removed, as well as the appendix. The postoperative course was entirely uneventful.

On Dec. 16, 1932, twenty-three days after the operation, a tubal patency test was performed which showed that the gas went through the tubes very easily. This test was repeated four weeks later and again the gas went through with a pressure of less than 70 mm. Hg. In June, 1934, the patient missed a period and Dr. Turman had an Aschheim-Zondek test performed which proved positive. On July 3, 1934, the patient had a miscarriage. She was advised to wait at least three months before attempting another pregnancy, but failed to do so. On Aug. 29, 1934, she fainted and began to bleed vaginally. Her last menstrual period had begun on July 17. Examination revealed dark blood in the vagina, a soft cervix, the body of the uterus slightly enlarged, not softened, except in the isthmus, and pushed over to the right side by a soft, cystic, slightly tender, irregular mass which

was presumably adherent to the uterus. A diagnosis of left ectopic pregnancy was made and operation advised. Laparotomy at the Chicago Lying-In Hospital (August 29) revealed a dark, almost black, irregular mass about 5 cm. in diameter protruding from the left uterine corner. The left tube, the one which had been implanted into the uterus, extended out from the dark mass. Its fimbriated end was perfectly normal. It appeared as if the mass had separated explosively the tube from the uterus. The left ovary measured about 8 by 6 by 6 cm. The small right tube was entirely covered over with peritoneum. The uterus was only slightly enlarged, slightly softened, anteflexed, and movable. The ectopic pregnancy was removed together with the left tube. Since the left ovary was the only one the patient had, almost 20 c.c. of serous fluid were aspirated from it and the ovary was left in situ. Knowing how anxious this patient was for a baby, a second salpingostomy was performed on the right tube. The patient left the hospital nine days after the operation.

Gross and microscopic examination of the specimen removed showed an early pregnancy. The villi were typical of those present in the first trimester of pregnancy. The patient was advised to avoid conception for at least one year. Three tubal patency tests were performed after the second operation, the last one on Jan. 28, 1936, and the remaining tube was found to be patent on each occasion.

This patient, therefore, had both an intrauterine and an ectopic pregnancy following a plastic operation on the tubes. Since the tube on which the salpingostomy had been performed was found to be entirely occluded, the pregnancies were made possible by the tube which had been implanted into the left uterine corner.

CONCLUSIONS

A review of the literature concerning salpingostomy and tubal implantation for the purpose of overcoming sterility does not present a favorable picture for these operations. The chief reasons for this are the relatively few live babies secured by these measures, the disproportionately high number of ectopic pregnancies which have resulted, and other complications which may follow such operations.

Questionnaires sent to members of the American Gynecological Society and the American Association of Obstetricians, Gynecologists and Abdominal Surgeons elicited the information that more than one-half of these specialists (60) who answered the questionnaires (107) were definitely opposed to salpingostomies and tubal implantations for the purpose of overcoming sterility, about one-fifth of the individuals were distinctly in favor of such plastic operations, one-seventh felt the operations were worth while occasionally, and the remainder did not express any opinion concerning the usefulness of these operations.

An analysis of about 818 plastic operations reported in the questionnaires revealed that 54 pregnancies took place after these operations, an incidence of 6.6 per cent, or one pregnancy for every 15 operations. However, since there were only 36 live babies delivered, the incidence of a successful result was only 4.4 per cent or one baby for every 22.5 operations. Ten of the 54 pregnancies (18.5 per cent) ended in abortion and 8 (14.8 per cent) were ectopic pregnancies. Hence only 66.7 per cent of the 54 pregnancies resulted in live children.

Careful selection of cases and improved technic of performing these plastic operations on the tubes will most likely yield a larger incidence of live children for those who feel inclined to perform these operations. There is certainly much more justification for doing them when the abdomen is opened for some specific indication, such as chronic appendicitis, ectopic pregnancy, or the removal of an ovarian cyst, than there is for performing the laparotomy solely for the purpose of operating on the tubes to correct sterility.

The following conditions should be present before a plastic operation on the tubes is performed: The patient must be in the childbearing period, preferably under thirty-five years of age; she must have at least one functioning ovary; both tubes or the only tube present must have been proved closed; there must be no other cause for sterility than tubal closure; there must be no gonorrheal, postabortal, puerperal or tuberculous infection in the genital tract, and the patient must be a good surgical risk. Of course, the husband must be fertile and healthy.

I wish to thank those who were kind enough to devote their time and energy in answering my questionnaires.

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55 E. Washington Street

NEPHROSIS IN PREGNANCY

Carl R. Wegner, M.D., St. Louis, Mo.

(From the Department of Obstetrics and Gynecology, Washington University School of Medicine and the St. Louis Maternity and Barnes Hospitals)

THE term "nephrosis" as used in this report designates a degenerative renal lesion as distinguished from an inflammatory one. To make that simple statement, however, does not convey an adequate concept of what the nephrotic syndrome consists of clinically. The following findings have quite generally been accepted as prerequisite to a diagnosis of nephrosis: marked generalized edema; normal blood pressure, nonprotein nitrogen, and kidney function tests; high blood cholesterol and total lipids; low serum protein and albumin-globulin ratio (latter frequently reversed); marked albuminuria; urinary casts and red blood cells not increased above normal; and the presence of doubly refractile cholesterol ester bodies in the urine. At autopsy the kidney tissue should show no inflammatory but a degenerative change involving principally the tubules.

Any condition whose characteristics can be so specifically postulated would on first thought seem easy of diagnosis. The difficulties encountered, however, are indicated in the following statement by Dunn, "Volhard from a wealth of experience has acknowledged that amyloid nephrosis and subacute nephritis alike may be indistinguishable by any criterion from simple chronic nephrosis during life, a conclusion also arrived at by Leiter from an exhaustive survey of the literature on this subject."

The observed facts which form the basis for this conclusion by the two recognized authorities just mentioned have led others seriously to

question the existence of nephrosis as an entity. Thus Christian says, "Nephrosis is the name of a clinical syndrome, but is the name of neither a disease nor of a definite pathological lesion." Likewise Blackman, "Nephrosis is a particular form of diffuse nephritis—," and Bell, "Lipoid nephrosis is not a distinct entity but a form of glomerulonephritis." In response to these last opinions, Leiter acknowledges that in its primary uncomplicated form nephrosis is a rare disease and then quite pertinently reminds that its rarity is, however, no justification for the denial of its existence. No attempt will be made here to credit or discredit the views of either side of this controversy.

The sole purpose of this writing is to place on record three cases that in the minds of those who studied them seemed to satisfy the conditions that would make a diagnosis of nephrosis acceptable. These three cases were among approximately twelve thousand obstetric patients admitted to the same service over a period of nine years. This gives an incidence of 0.025 per cent. The fact that these patients were all pregnant when first seen may have some significance in relation to the repeated observations of others that in certain cases the onset of nephrosis appears to be definitely associated with pregnancy, or in cases where a diagnosis is made prior to pregnancy the condition is aggravated greatly by pregnancy.

Brief case histories are submitted.

CASE 1.—E. L., white, gravida i, aged twenty-two, due May 27, 1927. Admitted to hospital Jan. 14, 1927, because of generalized edema. Significant findings on admission: pallor, general anasarca, double hydrothorax, ascites, edema of retinae, blood pressure 128/82. Marked albuminuria, casts (granular and hyaline), low plasma protein. During three and one-half weeks in hospital on high protein, restricted salt diet, there was marked clinical improvement and patient was discharged for observation in O.P.D. Admission weight 148, discharge weight 118. Alb. 4 gm/L—19 gm/L.

Readmitted Feb. 27, 1927, following spontaneous rupture of membranes and onset of labor. Delivered of macerated stillborn fetus. Edema very greatly improved. Blood pressure normal. Albuminuria persistent. Blood findings: anemia and low protein. In hospital four and one-half weeks. Admission weight 122, discharge weight 115. Alb. 4½ gm/L—11 gm/L. Sterilization recommended, refused.

Readmitted to hospital June 13, 1927, eight weeks pregnant. Edema of lower extremities. Albuminuria. Therapeutic abortion by hysterotomy and sterilization by tubal resection done. Uneventful recovery. Blood pressure normal.

Seen at irregular intervals during the following seven years. Subjectively had little complaint until four years had passed. Then began complaining of headaches and dependent edema. Urine constantly showed albumin.

Admitted to hospital again October, 1934, because of very marked edema, dyspnea, vomiting, and weakness. A severe anemia was also present at this time for which a transfusion was given. Cystoscopic examination showed a marked cystitis and pus coming from the right ureter. Hypertension and nitrogen retention were two important findings at this time. Left hospital under protest. Died within the next two months. Was not seen after last hospital admission. No autopsy. Laboratory details in table.

CASE 2.—I. McL., white, aged twenty-nine, gravida ii, para i, first seen in O.P.D., Jan. 19, 1932, at approximately thirty-two weeks' gestation. Came to Clinic because of marked edema of lower extremities and dyspnea for past four months. Admitted directly to hospital. History of similar course in first pregnancy two years prior, at which time she was induced at eight months, because of "kidney and heart disease." Following this delivery her symptoms disappeared promptly and she felt well. Had felt well for ten years prior to her marriage and first pregnancy at age of twenty-seven. Admission findings were: mild gingivitis, few râles in right base posteriorly, marked edema of lower extremities, with pitting to well above the knees. Blood pressure 130/85. Urine boiled solid and showed granular casts. After forty-eight hours in hospital the casts were reduced to just occasional occurrence and after the tenth hospital day no more casts were demonstrated although daily specimens were examined throughout the hospital stay. Doubly refractile bodies were constantly present in the urine.

Following complete laboratory study it was considered this case best could be classified under a diagnosis of nephrosis for the following reasons: Long history without progression, intermittency of edema, negative eyegrounds, marked albuminuria, absence of blood and casts (excepting appearance of latter in first urines following admission). Low basal metabolism rate, normal blood pressure, normal kidney function tests, low serum protein, high total lipids, decreased and reversed A/G ratio and constantly present doubly refractile bodies in urine.

Accordingly patient was placed on a high-protein, low-salt diet. Repeated basals showed –7, –7, –4 per cent.

Thyroid administration did not appreciably change the condition. The edema varied in amount from time to time, involving chiefly the most dependent portion of the body and influenced definitely by posture in bed. Edema of the labia occurred. Albuminuria varied from 3 to 15 gm/L during the hospital stay.

At approximately the thirty-seventh week, the labial edema made the patient very uncomfortable and consequently a medical induction with castor oil and quinine was attempted successfully. She was delivered of a 3,030 gm. living child. Following delivery there was immediate and marked improvement. The water balance previous to delivery was consistently positive, intake being restricted to between 1,500 and 2,000 c.c. Following delivery this was reversed and the urinary output exceeded the fluid intake for 7 consecutive days. Just before delivery the patient weighed 114 pounds. Eleven days postpartum she weighed 90 pounds. On discharge the twentieth day, postpartum, she weighed 94 pounds. Changes in the laboratory findings are noted in Table I.

In the three-year period following her second delivery this patient was seen on 3 different occasions: four and one-half months, fifteen months, and 40 months, postpartum. Subjectively she has had no complaints in this time and is doing all her own housework. The laboratory findings for this follow-up period also appear in the table. Reported as well and working hard March, 1936.

CASE 3.—J. T., first pregnancy at seventeen years of age, in 1930. Observed from October 3 to delivery on February 14 (8 clinic visits). In hospital from Oct. 8, 1930, to Oct. 10, 1930, because of blood pressure of 158/72 and 155/70 on first two clinic visits. Two blood chemistries, normal figures. Phenolsulphonephthalein normal, blood pressure not over 130/80. Discharged in two days to out-patient department. Blood pressure below 130 for next two clinic visits, then up to 140 and 150 again. No albumin.

Admission to hospital in labor Feb. 14, 1931. Blood pressure 148/80. Albumin plus. Delivered after sixteen hours labor of a 3,500 gm. living infant. Discharged twelve days postpartum. Blood pressure 120/80. Faint trace of albumin.

TABLE I.—NEPHROSIS

CASE	AGE	GRAVIDA	SYMPTOMS	TREATMENT	WEIGHT MAX.	WEIGHT MIN.	GEST.	TERMINATION
I E. L.	22 yr. Jan., 1927	i	General anasarca. Hydrothorax, bilateral edema of retinae. Pallor. Albuminuria	Bed rest. High protein, salt poor diet	148	118	23 wk.	
	Feb., 1927		Spont. rupture with onset of premature labor		122	115	30 wk.	Stillbirth
	June, 1927	ii	Edema of lower extremities. Albuminuria	Therapeutic abortion. Sterilization			8 wk.	Abortion
	Feb., 1929		No complaints					
	Mar., 1932		Dependent edema					
	Oct., 1934		Generalized edema. Headache. Nausea and vomiting. Dyspnea and weakness	Best rest. High protein, salt poor diet	108			
					Died in December, 1934			
II I. McL.	29 yr. Jan., 1932	ii	Generalized edema. Dyspnea. Dizziness. Spots before eyes	Bed rest. High protein, salt poor diet. Thyroid	114		32 wk.	
	Feb., 1932		Edema increase	Same	122		34 wk.	
	Delivered February					3030 gm. living child		
	Mar., 1932		No edema. Subjectively well	High protein, low salt diet		95	20 da. p. p.	
	May, 1933		No complaints	Unrestricted diet	98		15 mo. p. p.	
	June, 1935		No complaints. Working hard	Unrestricted diet	100		40 mo. p. p.	
III J. T.	21 yr. Jan., 1934	iv	Marked generalized edema. Palpitation. Dyspnea	Bed rest. High protein, salt poor diet. One blood transfusion. Two blood plasma infusions	197		16 wk.	
	Mar., 1934		Anasarca. Edema of labia. Backache	Bed rest. High protein, salt poor diet. 150 gm. acacia in glucose I. V. in 5 da. period. Whole blood transfusions. Additional 90 gm. I. V. acacia. Anti-strep. serum.	189		23 wk.	
					192		24 wk.	Delivery
						180	2 da. p. p.	
	Delivered April 11, 1934. Died April 17, 1934.							

*100% = 13.8 gm.

Second pregnancy. Aged nineteen, 1931. Observed from May 5, 1931, to delivery on Sept. 13, 1931. Blood pressure 138/74. Delivery spontaneous after eight hours of a 3,200 gm. living infant. Discharged eleven days postpartum. Blood pressure 125/75. No albuminuria at any time in association with second pregnancy.

Third pregnancy. Aged 20, 1933. Observed from January 24 to delivery on April 1 (6 clinic visits). Urine showed no albumin prenatally. Blood pressure ranged from 140/70 to 160/80. Admitted to hospital in active labor Apr. 1, 1933. Blood pressure 150/74. No albumin. Delivery after fifteen hours labor; 3,600 gm. baby, living. After delivery blood pressure never over 130 systolic. Had been on pre-eclamptic diet for six weeks before delivery. Discharged on eighth day postpartum.

Fourth pregnancy. Aged twenty-one, 1933. Came to clinic twelve weeks pregnant. Last menstrual period October 2. Estimated date July 9. Admitted to hospital for study. Shortness of breath, fatigue, palpitation, and marked edema since onset of pregnancy. Diagnosis of nephrosis based on: (1) Normal kidney function tests,

IN PREGNANCY

BLOOD PRESSURE	EDEMA	URINE				BLOOD					
		ALBUMIN	CASTS	R. B. C.	DOUBLY REFRACTIVE BODIES	*HB. %	SER. PROT. GM. %	CHOL. MG. %	N. P. N. MG. %	TOTAL LIPID MG. %	A/G RATIO
128/82	Generalized, marked	4-19 G/L	Hyaline	0	Present	67	3.1	560	30		1.0
120/65 110/50	Mild	4, 5-11 G/L	Hyaline	+	Present	59	3.4	375	30		
120/60 110/55	Mild	4-6 G/L	0	0	Present	75	3.1	466	37		
	None	4 G/L	0	0	Present	95	4.8	198	38		
	Mild	5 G/L	Hyaline	0	Present	89	5.5	390	89	903	
	Marked	6½ G/L	Hyaline Granular	+	Present	43	5.3	256	200	1170	1.14
130/85	Marked	6 G/L	Granular Hyaline	0	Present	77	4.0	400	27	1194	1.26
135/90	Marked	5 G/L	0	0	Present	74	4.0	364	27	1179	0.8
125/85	None	5 G/L	0	0	Present	86	4.4	372	35	969	1.23
130/85	None		Hyaline	0	Present	105	5.3	400	29	528	3.3
135/85	None	3 G/L	0	0	Present	95	5.8	375	20	677	
110/65 to 140/90	Marked	6-12 G/L	0	0	Present	88 105	4.6 5.6	552 720	18 26	1875	0.65 1.0
135/80	Marked	13 G/L	0	0	Present	3-12-34 91	4.5	727	28	1930	0.77
128/70	Marked	8 G/L	0	+	Present	3-17-34 77	3.9	485	31	1462	0.84
135/75	Marked	10 G/L	Hyaline Granular	+	Present	4-13-34 80	3.3	640	53	1255	

(2) normal blood pressure, (3) absence of casts and R.B.C. from urine, (4) albuminuria, (5) low serum protein, (6) A/G ratio less than 1, (7) high cholesterol and total lipids, (8) doubly refractile bodies in urine, and (9) normal eyegrounds.

Placed on high protein (2 or 3 gm. per Kg.), low salt diet. Weight decreased from 197 to 165 pounds (32 pounds) in first twenty-nine days in hospital. Still was not entirely edema free when she began gaining weight again.

In the next ten days she gained 11 pounds. As diet alone failed to relieve symptoms, patient given 675 c.c. citrated whole blood. Crying spell with rubbing of eyes resulted in so much edema of lids that patient could not see.

Hemoglobin after transfusion 105, blood serum protein still low so patient was given 275 c.c. blood plasma and 375 c.c. of blood plasma eight days apart. Continued to have low serum protein and tendency to regain some of the weight recently lost, although in general the clinical picture was one of improvement. At this time patient demanded release from hospital because of illness of her mother. Accordingly released under protest with instructions as to diet, rest and elimination.

During this hospital stay daily blood pressure reading ranged between 110/65 and 140/90, most at level of 125/70. Albumin varied between 6 and 12 gm/L. I.V. Phenolsulphonephthalein 80 per cent in two hours. Urea clearance 105 per cent normal. Creatinine excretion test: first hour 45, second hour 179, third hour 100.

After seven days at home she re-entered the hospital with marked edema that made it impossible for her to stay on her feet. In the preceding forty-eight hours there had occurred a tremendous edema of the labia. In the seven days at home she had gained 12 pounds in weight.

Elevation of foot of bed to relieve dependent edema resulted in shift of edema to upper trunk and consequent difficulty of respiration with coughing and some blood-tinged sputum. Within a few hours after leveling the bed, the labia began increasing in size again. Multiple punctures were made to relieve the painful tension in the labia which was very troublesome because the only position that the patient could maintain for more than a few minutes at a time was flat on her back with the thighs in wide abduction.

Since both diet and transfusion of whole blood and plasma failed to relieve the edema, the patient was given acacia solution intravenously. She received 500 c.c. of 6 per cent acacia in 20 per cent glucose for five successive days. (Total of 150 gm. acacia.) On the day the acacia was started the hemoglobin was 98, five days later it was 71. Then given whole blood transfusion of 650 c.c. One week later given 350 c.c. whole blood. Two days later given 750 c.c. whole blood. Hemoglobin back then to 87. Five days following the last transfusion and after fourteen days during which the q four hour temperature record showed no temperature over 37.4° C. the patient suddenly complained of chilling and temperature rose to 40.8° C. Lungs were clear. The following day patient went into spontaneous premature labor and delivered a twenty-seven-week-old living male infant, 1,100 gm., which lived 6 days. Two days following delivery, patient complained of generalized abdominal pain. Lungs clear. Abdomen markedly distended, central part resonant but dullness in flanks. Impression was: Free fluid in abdominal cavity, probably infected. Paracentesis considered but deferred. Given 650 c.c. of whole blood. Blood culture positive showing a gram-positive hemolytic streptococcus. Following day she was given 500 c.c. of 6 per cent acacia in 20 per cent glucose and 20 c.c. of antistreptococcus serum. That evening she was given 650 c.c. of whole blood and another ampoule of antistreptococcus serum. Following day 500 c.c. of 6 per cent acacia in 30 per cent glucose and 20 c.c. of antistreptococcus serum were given. Later same day given 700 c.c. citrated whole blood and 20 c.c. antistreptococcus serum. Following day was given 6 per cent acacia twice in glucose. Died Apr. 17, 1934.

The organisms cultured from the blood stream were gram-positive hemolytic streptococci that grew best anaerobically. Organism cultured from peritoneal cavity at autopsy, gram-positive hemolytic streptococcus.

Autopsy report: Nephrosis, fatty liver, peritonitis, hydrothorax and hydropericardium, and septic spleen.

DISCUSSION

CASE 1.—E. L. The marked daily loss of urinary albumin, 4.5 to 11 gm. per liter, made it especially interesting to know more about the N balance of this patient. Peters, Bulger and others have shown by complete studies in nephritis that the urinary N, while it does not represent all the N lost, is still an index of body catabolism. Table II gives the results of metabolism studies on this patient over a period of twenty-three consecutive days immediately following her first hospital admis-

sion. Fluids were not limited although the intake was never great. Diuresis was marked and prolonged. The NaCl output was rather low, the level of excretion usually falling between 0.1 per cent and 0.4 per cent. A marked albuminuria was persistently present. It is significant that this was uninfluenced by diet. There were wide variations in the albumin content of different specimens, the average falling at approximately 0.5 per cent or 5 gm. per liter. The specific gravities of the urines varied between 1.022 and 1.006 with an average of 1.011. The N intake and output were about equal for the duration of the test.

TABLE II. METABOLISM STUDIES ON CASE 1 DURING FIRST HOSPITAL ADMISSION. FIGURES REPRESENT AVERAGES FOR FOUR CONSECUTIVE FIVE-DAY PERIODS

DATE	LB. WEIGHT	C.C FLUID INTAKE	C.C. URINARY OUTPUT	ALBUMIN %	ALBUMIN GM./24 HR.	NaCl %	NaCl GM./24 HR.	TOTAL N OUTPUT	TOTAL N INTAKE	N BALANCE
1927										
Jan. 15 to 19 incl.	144.3	1,086	1,775	0.66	10.4	0.34	5.7	7.6	6.0	-
20-24 incl.	137.5	1,145	1,576	0.60	9.2	0.32	5.1	6.2	6.9	+
25-29 incl.	127.6	1,016	2,296	0.62	14.3	0.36	8.46	8.1	7.9	-
Jan. 30 to Feb. 3 incl.	118.9	1,530	1,572	0.65	10.3	0.38	6.1	7.4	7.7	+

This patient promptly showed a definite increase in edema and albuminuria from the onset of the second pregnancy. While the edema disappeared following the abortion, the albuminuria never entirely cleared. During the last three years of her life there was a gradual but certain rise in blood pressure and in the last few months a degree of hypertension and nitrogen retention that established the terminal condition as one of chronic nephritis.

CASE 2.—I. McL. Unfortunately, we have no observations on this patient in her first pregnancy. After the complete study made in the latter part of her second pregnancy, however, it would seem quite apparent that the unfavorable signs and symptoms observed then were simply a repetition of what occurred also in her first pregnancy, and that the original diagnosis of "kidney and heart disease" resulted from a misinterpretation of the etiology of the generalized edema and marked albuminuria noted by the attending physician at that time. The points of particular interest in this case are that she was able to carry on in what she considered a perfectly normal manner when not pregnant, that the onset of a pregnancy each time was immediately associated with the unfavorable signs noted in the history, that these signs became progressively worse to the point where they demanded early induction of labor, that prompt relief of the subjective symptoms followed delivery, and that the patient continues to be free from any subjective complaints. She is now in her fifth year since her last delivery.

CASE 3.—J. T. This patient was observed through three pregnancies before developing her serious difficulty in the fourth. She showed an occasional tendency to mild elevation of blood pressure. There was never any nitrogen retention and each time there was a prompt return of blood pressure to normal on bed rest. No hypertension was ever noted postpartum. From the very onset of the fourth pregnancy edema was a prominent feature, in fact was the reason for the patient's coming to the clinic in her twelfth week of gestation. As soon as the nephrotic character of her difficulty was recognized, an attempt was made to raise the level of her blood protein and to reduce the edema. High protein diet, whole blood transfusion, blood plasma infusion and gum acacia infusion were used. The initial response to forcing 2 or 3 gm. of protein per kg. of body weight and restricting salt at bed rest was favorable, particularly in reducing the edema, but later became quite ineffective. There was no appreciable effect on the level of the blood protein. For this reason a whole blood transfusion, 675 c.c., was given, following which the hemoglobin was found to be well over 100 per cent with the total proteins still low. This was the indication for the blood plasma infusions which, however, also failed to improve the total protein level. It was very unfortunate that the illness and death of the patient's mother at this point caused her to demand release from the hospital, for on her return seven days later, she was more edematous than at any time previously. Since diet and infusion of both whole blood and blood plasma failed to improve the condition, it was now decided to try the effect of intravenous gum acacia. Hartmann has reported good results from the use of acacia in the treatment of nephrosis in children. The amount of acacia given to this patient was not as great, calculated on the basis of body weight, as was found necessary to produce satisfactory results in some of the patients treated by Hartmann. A moderate increase in urinary output with corresponding decrease in edema followed the use of acacia, but the serum protein dropped to even lower levels than had been present before. Since the passing of this patient, there has been reported the successful treatment with intravenous acacia of a case of nephrosis in an adult woman by Barach and Boyd. Their patient was twenty years of age, was given 295 gm. of acacia intravenously over a period of four weeks following which she was discharged as "cured." She remained well under observation for one and one-half years after the acacia treatment and then went through an uncomplicated pregnancy. The untimely death of our patient resulting from an acute streptococcic blood stream infection and peritonitis of unexplained origin precluded the possibility of further observation and estimation of the value of the acacia treatment.

Each of these three cases of nephrosis in pregnancy has followed a different course. The first passed over into a chronic nephritis which proved fatal seven years after the patient first came under observation;

the second carries on in a manner quite satisfactory to herself until she becomes pregnant when the typical picture of nephrosis presents itself in constantly increasing severity until relieved by delivery; the third succumbed to a peritonitis of unknown origin. Other writers have called attention to this same triad of fates any one of which may be the lot of these unfortunate individuals. The patient in Case 2, still living, represents that group that may live for an indefinite period of years until finally carried off by some intercurrent infection.

The effect of pregnancy on nephrosis is very interesting and particularly significant in the light of the observation that repeated reports definitely link the onset of the condition with a pregnancy. The significance of this lies in the fact that even in normal pregnancy certain changes occur in the kidney which simulate the changes noted in nephrosis, and which for want of a better term have been designated as "the kidney of pregnancy." It requires no great stretch of the imagination to picture the possibility of an individual with a nephrotic tendency becoming pregnant and then under this double influence (in an unfavorable direction) developing the typical clinical syndrome of nephrosis. It is also quite possible that in certain susceptible individuals the nephrotic tendency initiated by pregnancy alone may develop to such a marked degree during the course of the pregnancy that the typical clinical picture of nephrosis results and persists even after delivery has occurred. Viewed in this light pregnancy must be considered as carrying a very real hazard for the woman with a known nephrosis or nephrotic tendency.

One of the chief difficulties met in the management of these cases is to keep the protein intake at a satisfactorily high level. All three of these patients tired very quickly of the prescribed high-protein, salt-poor diet. No doubt an important factor in this anorexia is the withholding of salt.

One more point should be covered in conclusion and that is the question of casts and red blood cells in the urine. It will be seen from Table I that two of these patients from time to time showed casts and red blood cells. Addis has proved that normal individuals, if studied consistently, will excrete these formed elements, sometimes in quite large numbers. Goldring, reporting in 1931, considered the excretion of 500,000 R. B. C., and 5,000 casts per twelve hours, as normal. More recently Elden and Cooney in working with the Addis count in pregnancy found that the excretion of casts and red blood cells in normal pregnancy is greater than the values accepted up to the time of their report (1935) for normal nonpregnant individuals. It becomes obvious then that if any significance is to be placed on the presence of casts and red blood cells in the urine, they must be excreted *in excess* of the number found in normal individuals. Also the finding of Elden and Cooney that preg-

nant women have a higher excretion level of these elements than non-pregnant women is pertinent to this report in that all three of these patients were pregnant when the studies were made.

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MALIGNANCIES OF THE VULVA

P. E. HOFFMANN, M.D., SAN FRANCISCO, CALIF.

(From the Department of Obstetrics and Gynecology, Stanford University School of Medicine)

OF 27,380 patients seen in the Women's Clinic of the Stanford School of Medicine between 1918 and 1935, 413 or 1.5 per cent were afflicted with malignancies of the genital organs, with a primary seat of origin in the vulvar region in 20 or 4.8 per cent. Although this disease is relatively common, the literature which has accumulated on this subject since Morgagni gave the first accurate account in 1751 is not extensive.

Europe has contributed the greatest number of records of this disease, and collected statistics of importance may be found in contributions by Mayer,[1] Dittrick,[2] Bell,[3] Rothschild,[4] Basset,[5] Ederle,[6] and Kehrer.[7] American statistics are comparatively meager. Taussig[8] recorded the data of 76 cases of vulvar carcinoma seen by him over a period of twenty-two years. Rentschler[9] reported 71 cases of epithelioma of the vulva seen at the Mayo Clinic between 1907 and 1927. Stein,[10] Noble,[11] Reid,[12] Brady,[13] Massey,[14] Broders,[15] and Goforth[16] have added case reports to the earlier literature.

It is generally agreed that vulvar malignancies are best divided according to their frequency of occurrence, into (1) carcinoma, (2) sarcoma, (3) embryonal tumors, (4) melanoma, and (5) metastatic tumors, as chorioepithelioma or hypernephroma. Of these, only carcinoma is fairly common. Taussig[8] suggests that the latter should again be subdivided according to frequency and location, into epidermal cancer, cancer of the clitoris, vestibular cancer, and cancer of bartholinian gland. According to location, the twenty cases seen by us group themselves as follows: labia majora 8, prepuce 3, labia minora 2, combined types 5, bartholinian gland 1, and urethra 1.

Kehrer,[7] who collected 910 cases of cancer of the vulva from the German literature, found that 40 per cent occurred at the labia majora, about 15 per cent at the labia minora, 17 per cent at the clitoris, 0.2 per cent in bartholinian gland, and the remaining 27.8 per cent were of the vulvourethral, fourchette, or combined types. While there are differences in the percentage of location according to size of series reported, it is evident that the labium majus is the commonest site of occurrence.

Malignancy of the vulva rarely occurs before late middle and old age. In Rothschild's[4] tabulation of 331 cases, the incidence was greatest in the sixty- to seventy-year group. It very seldom occurs in young women. In our series, 3 occurred in the fourth decade, 4 in the fifth, 2 in the sixth, 7 in the seventh, 3 in the eighth, and one in the ninth.

Cancer of the vulva is very frequently preceded by leucokraurotic changes (Graves and Smith,[17] and Taussig[8]). Since there seems to exist a relation between cessation of ovarian activity and leucoplakia and kraurosis, the former may constitute an etiologic factor. Eight of our patients showed definite leucoplakia of the vulva at the time malignancy was discovered. The relative frequency of malignancy in the region of the clitoris and prepuce has been attributed to the common occurrence of leucoplakia in this location. Often both of these structures are involved, and the site of origin is not easily determined. Only about 14 per cent of all cancers of the vulva occur at the vestibule (Taussig,[8] Kehrer[7]), where leucoplakia is less common.

It is of particular interest that Taussig[8] found that eight of his ten cases of vestibular cancer originated in the margins of syphilitic ulcers. We found a similar occurrence in a white woman, who, according to an undisputed microscopic diagnosis, had a carcinoma of the labium majus which cleared up under antisyphilitic treatment. Vulvar carcinoma is rare in negresses. Taussig[18] observed only three, and two of these, also, occurred in the margins of tertiary syphilitic lesions of the vestibule. In our series, there was only one negress.

Trauma has been mentioned as a predisposing factor (Kehrer[7]). Multiparity, however, cannot be considered as a factor, since many cases have occurred in nulliparous women. According to Ewing,[19] the incidence of traumatic tumors is found to be extremely low. A single trauma of normal tissues, according to most pathologists, is incapable of producing a malignant tumor. Repeated trauma to successively altered tissues is more likely to cause malignant changes than is a single injury. That injury usually accelerates the growth of tumor cells is not supported by experimental and clinical evidence.

Primary cancer of bartholinian gland develops as a subdermal tumor and is most often an adenocarcinoma. Whenever such a cancer is made up of squamous cells, it has arisen from the epithelium of the ducts (see Fig. 1). Infection apparently plays no important rôle in

its etiology. The incidence of carcinoma of the bartholinian gland is insignificant when compared with the common occurrence of infection of this structure. The case of cancer of bartholinian gland reported here was of the squamous cell variety, and there was no history of previous infection in this instance.

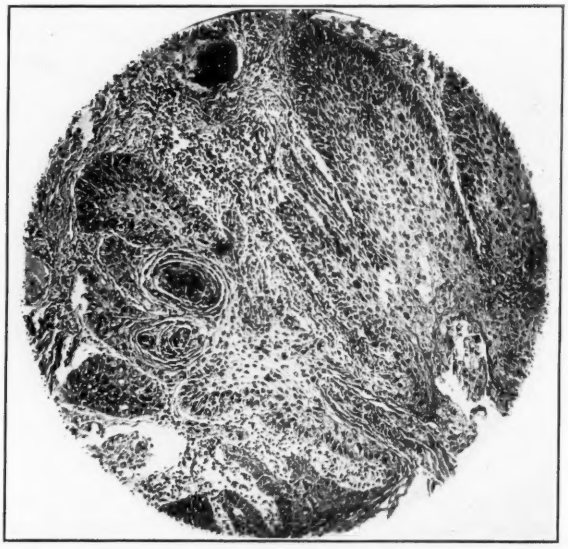

Fig. 1.—Epithelioma of bartholinian gland duct (low power).

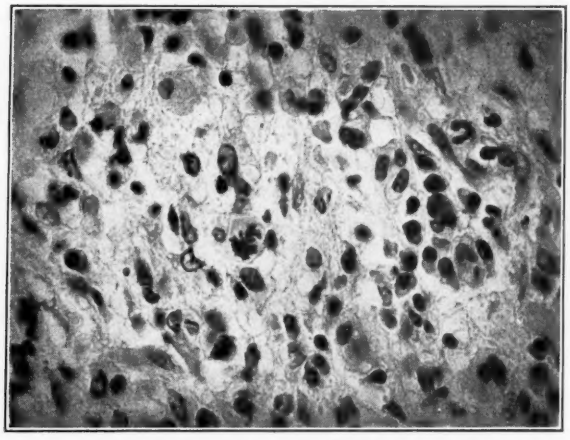

Fig. 2.—Sarcoma of urethra. (Mitosis.) (High power.)

Up to 1913, Rothschild[4] found only 35 cases of sarcoma of the vulva reported in the literature. This type of tumor is seen most often in younger patients. Its common site of origin is the labium majus. Kelly[20] reported one case of myxosarcoma of the clitoris. We have observed one mixed-cell sarcoma of the urethra or periurethral region (see Fig. 2).

As far as could be ascertained from the literature, only 3 cases of teratoma of the vulva have been reported. All of these occurred in very young children. Ley[21] reported the presence of such a lesion at birth, which was characterized by rapid growth and ulceration.

Metastatic tumors of the vulva are very uncommon. The first report of metastatic chorionepithelioma of the vulva was made in 1895 by J. Whitridge Williams.[22] In 1929 Kehrer[7] reported one case of metastatic sarcoma, 2 cases of metastatic hypernephroma, and 11 cases of metastatic chorionepithelioma.

Malignant melanomas, which were formerly classed with sarcomas, are now generally grouped with tumors of epithelial origin.

Bell[3] found that this type of tumor occurred most often in women past fifty years of age. As far as is known, it always originates in a pigmented mole and metastasizes very early to the regional lymph glands. It is generally agreed that this tumor offers an extremely bad prognosis. Goforth[16] and Holland[23] reviewed 52 cases of melanoma and found that 72 per cent occurred in the sixth decade. All investigators stress the point that pigmented nevi, particularly those of the pubic region, furnish the starting point for this most malignant tumor.

With the exception of the melanomas and sarcomas, a neoplasm of the vulva usually appears as a hard nodule in the skin or the mucosa, simulating an inflammatory lesion. Cancer of bartholinian gland and of the clitoris most often develops in the subdermal tissue. Contact implants on the opposite labium are a frequent occurrence, and, according to Franke,[24] such transplant formation may be the result of (1) invasion by carcinoma through the blood or lymphatic vessels, (2) mechanical irritation of the tumor itself, (3) lowering of the local resistance caused by the secretion of the ulcerated tumor, (4) direct transplantation of masses of cells, and (5) the implantation of the organisms, if organisms can produce carcinoma. Perhaps direct transplantation into a contact area made suitable for implantation because of surface maceration is the most likely explanation.

The symptoms observed in the various types of malignancies of the vulva are fairly uniform, and are characterized by itching, burning, lump formation, ulceration, pain, and dysuria. The discovery of a "lump" was the outstanding complaint in fifteen of our twenty cases. In nine instances, there was an additional complaint of intense itching at the site of leucoplakia. In three instances, burning on urination was the predominant symptom. Bloody discharge was observed by several patients. In the more advanced cases, edema and a radiating pain down the legs were present.

It is sometimes very difficult to differentiate early cancers from leucoplakia. Biopsy is a very important diagnostic procedure in all cases, as any form of chronic hypertrophic or ulcerative vulvitis, chancroid, or granuloma may simulate cancer of the vulva. Melanomas usually can be diagnosed from the pigmentation present. Syphilitic ulcers may present difficulties in diagnosis, but the Wassermann re-

action and the results of antisyphilitic treatment usually establish the diagnosis. In eighteen of our twenty cases, the diagnosis of malignancy was made clinically.

The cytologic composition of these tumors, to a certain extent, is dependent upon the site of origin. Most of them are epitheliomas, and it is common to find a well-differentiated cell picture of large areas of pavement epithelium with pearl formation (see Fig. 3). In some instances the downward involvement is slight, although the surface proliferation may be great. In such tumors, mitotic figures are infrequent. Certain tumors are characterized by anaplasia and great cell activity, with less differentiation and greater invasion of the underlying tissues. The latter type is most frequently seen in younger patients, particularly if the neoplasm has arisen in a syphilitic ulcer.

Fig. 3.—Epithelioma of vulva, pearl formation (low power).

We have divided our tumors into mature, mid-mature, and immature types, following essentially the classification of Schottlaender and Kermauner.[25] Accordingly, "mature" indicates a cell differentiation which approaches that of the normal squamous epithelium. "Immature" indicates a cytologic picture which shows no resemblance to the parent tissue but approaches the cell appearance in the embryonic state. Cell outlines cannot be made out clearly, and nuclei vary greatly in size and shape. Anaplasia is common. The "mid-mature" type occupies a position midway between the other two types, and may vary considerably in cellular appearance.

The treatment of cancer of the vulva should depend upon the extent of the disease and the general condition of the patient. It may consist of surgery or irradiation, or both. The prevailing opinion is

that vulval cancer is best treated by surgery, since it alone offers any appreciable chance for cure, and that irradiation should be reserved either as an adjunct to surgery or as a palliative measure. As a general rule, wide excision of the growth, including the regional lymph nodes, should be the method of choice. It is doubtful that postsurgical irradiation is of value in borderline cases. In advanced cases, the placing of radium needles, followed by roentgen irradiation, may give temporary relief. Local lesions may respond surprisingly well to deep therapy, but as a rule the course of the disease remains unchanged. Whenever leucoplakia is present, removal of the neoplasm should include all of the leucoplakic area. This offers the best protection against further malignant degeneration.

There are various surgical methods for the radical removal of lymph glands.

Basset[5] advocated a two-stage operation, with a systematic resection of the lymph-glands in the first stage, followed by vulvectomy after the inguinal incisions have healed. The great advantage of this procedure lies in the shortened postoperative course. Stoeckel[26] and Kehrer[7] devised an operation for the removal of the iliac glands in addition to the deep and superficial inguinal glands. This operation carries a primary mortality ranging from 11 to 15 per cent. Taussig,[8] using a modification of the Bassett technic, reported an operative mortality of only 3.3 per cent. In his opinion, the primary mortality is considerably reduced if intraperitoneal manipulation is avoided.

Janeway and Bailey[27] were among the first to employ radium and x-ray in the treatment of cancer of the vulva, but final results have not been reported. In 1926 Heyman[28] reported 64 patients who, because of inoperability, were treated palliatively by irradiation. Twenty-one showed no improvement, but for the remaining patients he reported one 7-, one 6-, one 5-, one 4-, one 3-, and five 2-year cures. Collecting 126 patients treated by irradiation, including Heyman's series, Taussig[8] found only 15 cures of over five years' duration. It would be faulty to compare these results with those obtained in selected operative cases, since many of them were considered inoperable before treatment. Eleven of our cases were considered inoperable and were therefore treated by irradiation. Two of these died soon afterward from other causes (suicide, cerebral hemorrhage). The average duration of life for the remaining 9 patients was sixteen months. One patient lived for two years and four months after irradiation.

Tausch,[29] in his review of 47 cases of vulvar carcinoma, reported 24 patients operated upon radically with additional deep roentgen therapy in 8, and a combination of x-ray and radium in 15. In the latter group, only one patient survived five years, but died a few months later from a recurrence. Of the 39 patients treated surgically, with or without postoperative irradiation, 16 remained alive for more than five years.

Taussig[8] reports discouraging results from irradiation. Of 15 patients treated with deep x-ray and radium, only one survived the three-year period. The poor results are probably due to the high incidence of well-differentiated radium-resistant tumors, the ineffective results of x-ray treatment on inguinal and femoral metastases, or the advanced stage of the growth.

Preoperative irradiation has not been given a sufficient trial to be evaluated. Marcus[30] reported two patients in whom operation was preceded by x-ray and radium exposures, and a histologic study of the regional glands revealed no effect from irradiation. He concluded that vulval carcinoma should be treated by radical operation alone.

Patients suffering from *sarcoma* of the vulva or *carcinoma* of the clitoris have, in every instance, in spite of *any* treatment, died very soon after the discovery of the tumor. All cases of operative removal of teratomas of the vulva proved fatal. Epitheliomas, especially those originating in leucoplakic areas, present a more hopeful outlook.

Taussig[8] reports 81.8 per cent of five-year cures of *operable* cases treated radically according to Basset's technic. On the other hand, Rentschler[9] believes that the prognosis is fair only for the prolongation of life, but poor for a cure regardless of the type of operation or operation followed by irradiation. Of the 62 patients in his series, 44 died within five years, the average duration of life being two years and one month.

The treatment of melanomas of the vulva by either surgery or irradiation gives uniformly poor results. In Holland's[23] series, most of the patients were dead within six months after operation.

Taussig[8] and Goforth[16] concluded that all pigmented nevi of the vulva should be regarded as malignant and treated by wide excision with a wide margin of healthy tissue removed in all directions. If any degenerative change has occurred, the nevus, together with the regional lymph glands, should be removed.

SUMMARY

Twenty cases of malignancy of the vulva were studied. Five were treated by radical vulvectomy, and 4 by local excision and irradiation. The remaining 11 patients received irradiation only. Of those treated by radical operation, 3 are still well after three, four, and five years. One patient of the 4 treated by local excision and irradiation remains free from recurrence, and the other 3 died three, six and fifteen months after operation. Of the 11 patients treated by irradiation alone, the longest survival was two years and four months.

CONCLUSIONS

Because of the high incidence of well-differentiated tumors, surgery offers the best chance for permanent cure in vulvar malignancies, provided the neoplasm in question belongs to the operable group. Irradiation is essentially a palliative measure.

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THE TREATMENT OF DYSMENORRHEA*

LEDA J. STACY, M.D., AND ROSEMARY SHOEMAKER, M.D.,
ROCHESTER, MINN.

(From the Mayo Foundation)

THE relief of primary dysmenorrhea has been a baffling problem always. The young woman may have very severe pain, with nausea and vomiting, keeping her in bed for one or more days each month, yet pelvic examination may disclose that the uterus, oviducts, and ovaries are in normal position and of normal size. In some instances a small, firm uterus, the body of which is acutely anteflexed, the hypoplastic type of uterus, is found as the only abnormality.

In earlier days the only advice these patients were given was that pregnancy would bring relief and in case pregnancy was not anticipated or did not occur soon after marriage dilatation and curettage was advised, because the pain was thought to be attributable to obstruction to the escape of menstrual blood. In a number of cases the dysmenorrhea persisted after delivery and in most instances dilatation and curettage gave only temporary relief of pain.

With the advent of various ovarian extracts, and more recently of the hormones, it was hoped that these substances would, in some mysterious way, bring relief to this large group of women who are seriously handicapped by the pain accompanying a normal physiologic function. Perhaps when more is known of the part played by the hormones concerned in the menstrual cycle, the cause of the accompanying pain may be determined and means may be found to relieve it. At present the giving of estrogenic hormones to a patient whose uterus is undeveloped seems to be the only logical indication for use of the hormones in treatment of dysmenorrhea. Experimentally and clinically it has been shown that the estrogenic hormone stimulates growth of the uterus and the luteal hormone has been shown to have an antispasmodic effect on the uterine muscles.

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In many cases of severe menstrual pain there is an abnormal nervous background and the tolerance to pain is lowered. These undoubtedly are etiologic factors and careful attention to the psychic and physical habits of the afflicted young women often is more effective in obtaining relief than is the use of drugs.

A review of the literature fails to reveal an analysis of a series of cases of dysmenorrhea in which treatment has been by various methods and the patients have been observed for a sufficient length of time to establish definite conclusions regarding the efficiency of the various methods of treatment available. Boynton has outlined a controlled study of cases of dysmenorrhea but sufficient time has not elapsed to allow the ultimate results of treatment to be reported.

The report of the following study is of questionable value because of (1) the difficulty in evaluating the answers to the questionnaires sent these patients, (2) the irregularity with which the patients took the medicine prescribed and (3) the fact that severity of the pain in some cases required administration of an analgesic while the more slowly acting medicine was being tried out. While nothing new is offered regarding the etiology or the cure of dysmenorrhea we felt that study of the cases would be of interest and perhaps of some value.

THE INVESTIGATION

From Jan. 1, 1931, to Jan. 1, 1934, 682 cases in which a diagnosis of dysmenorrhea was made were encountered at the Mayo Clinic. Of these, certain cases were excluded from the study: (1) In 112 cases dysmenorrhea was incidental to the chief complaint or was not of sufficient importance to require medication. (2) In 37, surgical operation was advised but the patients refused to submit to it. (3) In 104 cases some surgical procedure was carried out; dilatation and curettage, suspension of the uterus, resection of presacral nerves, and hysterectomy constituted the majority of these operations. (4) In 38 of the cases some pelvic pathologic condition was deemed responsible for the pain. Because this study was undertaken to determine the efficacy of the various drugs and hormones, only cases in which pelvic examinations revealed normal reproductive organs were reviewed. (5) Replies to follow-up letters were not received from 129 of the patients treated medically. This study, therefore, is based on a review of 262 cases.

Some incidental observations made in the survey may be of interest. There were 132 single patients; of the 130 married women 47 had had children when the study began. Thus of the married women 36.1 per cent had not been benefited by that age-old "cure" of dysmenorrhea, the bearing of children. However, 22 patients subsequently became pregnant and of these, six were completely relieved, the dysmenorrhea returning after varying intervals of time, and the dysmenorrhea of six was not affected in any way by pregnancy.

In the histories of 82 of the 262 cases were noted psychic factors such as "chronic nervous exhaustion" or "nervous instability," which often are responsible for lowering the threshold for pain of the individual. Headache and migraine were associated with the pelvic pain at menstruation in 43 cases. Forty-three patients had already submitted to pelvic operation in an attempt to obtain relief but without the desired result, but the normal condition of the reproductive organs was not affected.

For convenience in evaluating treatment the following classification was made according to the treatment given: (1) antispasmodics; benzyl benzoate, belladonna, calcium, viburnum; (2) analgesics, such as a preparation of amidopyrine plus a derivative of barbital known as cibalgin; (3) sedatives, such as phenobarbital (elixir of luminal) and the bromides; (4) endocrine products: estrin (progynon), luteolipoid of corpus luteum (sistomensin), ovarian extract, placental hormone (emmenin); (5) roentgen therapy: (a) light dosage to ovaries and pituitary, or (b) menopausal dosage over the ovaries; (6) radium. Frequently treatment belonging in more than one group was prescribed in a single case, and in these cases we have attempted to credit each preparation as best we could from the replies received from the patients. The results have been gathered and presented in Tables I, II, and III to facilitate comparison. "Complete relief" indicates either entire disappearance of pain at the periods of flow or control of the pain while using the treatment; similarly, "partial" or "improved" refers to permanent lessened severity of the pain or lessened severity of the pain during treatment.

One hundred and thirty-nine patients received, as the main medication, one or more of the analgesics, antispasmodics or sedatives (Table I). Of these, 71, or 51 per cent, received benefit. Three of these reported that they rarely had any discomfort subsequent to a course of medication. In these 3 cases cibalgin (two years), cibalgin and belladonna (one and a half years with an occasional dose thereafter), and calcium lactate (the patient was still taking it at the time of writing) were used.

Some one of the endocrine preparations, either alone or together with analgesics, was prescribed in 129 instances (Table II) and 78 of the patients (60 per cent) were relieved of the dysmenorrhea. Of the patients who received the endocrine preparations a large percentage gave histories of an irregular cycle, of menorrhagia, or of oligomenorrhea as well as of dysmenorrhea, and an attempt was made to select the preparation which at that time was considered indicated in the individual case to control the menstrual irregularity as well as the dysmenorrhea.

In the 36 cases in which ovarian extract was given, all types of variation of the menstrual cycle were noted. Of the 4 patients who reported complete relief of the dysmenorrhea while the medication was being given, 1 was still using the treatment when this study was made; 2 reported little or no pain without the medication, and 1, after having secured complete relief for three months from ovarian extract alone, and for one year from anterior pituitary and ovarian extract combined (given elsewhere) was troubled with a gradual return of the severe dysmenorrhea at the time of writing this report. Of the 17 patients whose condition was improved by the use of ovarian extract for varying periods of time, 12 reported that they subsequently had dysmenorrhea such as had troubled them before treatment and 5 had pain which was not as severe as that experienced before treatment.

Of the 22 patients who received progynon, the menstrual cycles of only 5 were irregular. The periods of 2 of the 5 became regular, and of 2 the cycles remained irregular after medication. One of the 6 patients who obtained no relief from medication has since had a baby, with temporary relief of menstrual pain but with later return of severe pain. The condition of another was improved for some months after the medication. Later she had a miscarriage, with relief of the dysmenorrhea for a short while; although the dysmenorrhea had returned it was not as severe as it had been formerly. The 15 patients who received benefit from the treatment in lessened severity of dysmenorrhea (Table II) are of particular interest. Improvement of two of these remained permanent after discontinuation of the medication. The dysmenorrhea of 13 of the patients who were relieved while taking progynon became severe again after medication had been stopped for several months. One patient reported that the next period after discontinuation of the treatment was ac-

TABLE I. SUMMARY OF RESULTS OF TREATMENT CHIEFLY* WITH ANALGESICS, ANTISPASMODICS, AND SEDATIVES

SUBSTANCES ADMINISTERED		TOTAL CASES	RELIEF OBTAINED, CASES		
SUBSTANCE OF MOST IMPORTANCE	COMBINED WITH		COMPLETE	IMPROVEMENT ONLY	NONE
Benzyl benzoate (benzylettes)	Nothing else	18	0	9	9
	Amidopyrine + derivative of barbital (cibalgin)	6	0	2	4
	Endocrine products	10	0	3	7
Amidopyrine + derivative of barbital (cibalgin)	Nothing else	18	1	9	8
	Belladonna	16	1	7	8
	Hammond's mixture	4	0	1	3
	Calcium lactate	5	0	4	1
	Acetylsalicylic acid (empirin)	1	0	1	0
	Endocrine products	25	4	15	6
Belladonna	Nothing else	2	0	0	2
	Phenobarbital (elixir of luminal)	9	1	3	5
	Hammond's mixture	1	0	1	0
Hammond's mixture	Nothing else	5	0	2	3
Viburnum	Nothing else	7	0	4	3
Acetylsalicylic acid (empirin)	Nothing else	1	0	1	0
Phenobarbital (elixir of luminal)	Nothing else	3	0	0	3
Calcium lactate	Nothing else	3	1	0	2
	Luteolipoid of corpus luteum (sistomensin)	5	0	1	4
Totals		139	8 (5.7 per cent)	63 (45.3 per cent)	68 (48.9 per cent)

*The endocrine products represented in the table apparently had little, if any, effect.

TABLE II. SUMMARY OF RESULTS OF TREATMENT CHIEFLY WITH ENDOCRINE PRODUCTS

SUBSTANCES ADMINISTERED		TOTAL CASES	RELIEF WHILE TREATMENT WAS CONTINUED, CASES			RETURN OF PAIN ON CESSATION OF TREATMENT, CASES	
SUBSTANCE OF MOST IMPORTANCE	COMBINED WITH		COMPLETE	IMPROVEMENT ONLY	NONE	MILD	SEVERE
Ovarian extract	Nothing else	16	4	17	15	5	12
	Analgesics	20					
Estrin (progynon)	Nothing else	16	1	15	6	0	13
	Analgesics	6					
Luteolipoid of corpus luteum (sistomensin)	Nothing else	8	1	15	11	0	15
	Analgesics	19					
Placental hormone (emmenin)	Nothing else	18	1	10	7	8	13
	Analgesics	26	0	14	12		
Totals		129	7 (5.4 per cent)	71 (55 per cent)	51 (39.5 per cent)	13 (10 per cent)	53 (41 per cent)

companied by the usual pain. Five of the 13 women were able to remain comfortable with the aid of analgesics of the type of acetylsalicylic acid after they discontinued the use of progynon. One has since been relieved entirely by insertion of a silver spring pessary by her home physician. Two of the patients whose condition was improved had undergone previous operations for dysmenorrhea without benefit.

Of the 27 patients who received sistomensin, 9, or 33 per cent, had menorrhagia and in those cases sistomensin was chosen because of a desire to lessen the amount of bleeding as well as to observe the effect of the preparation on the dysmenorrhea. Five of these patients have reported a normal amount of flow. The menstrual cycle of all but four patients of this group was regular. The pain of one patient was completely relieved for one year. Later she reported, however, that she had severe pain until the flow began. Fifteen obtained partial relief which lasted from a few months to three years following treatment; all have reported return of the severe pain after discontinuing the medication. One of them has been entirely cured by dilatation and curettage performed later elsewhere.

Of the 44 patients who were given emmenin, 11 (24 per cent) had irregular periods and the cycles of 4 of these 11 patients subsequently became regular. One woman, twenty-two years of age, who had had dysmenorrhea for two years, was completely relieved of pain after she had taken emmenin for only one month. Eight of the patients whose dysmenorrhea returned after cessation of the medication have reported that the pain is less severe than it was before treatment. Thirteen who had been relieved while taking emmenin said that the dysmenorrhea was as severe after discontinuing the medication as it had been before the start of medication.

TABLE III. SUMMARY OF RESULTS OF TREATMENT WITH ROENTGEN RAYS AND RADIUM

KIND OF TREATMENT	DOSE	TOTAL CASES	RELIEF ATTRIBUTABLE TO TREATMENT, CASES		
			COMPLETE	IMPROVEMENT ONLY	NONE
Roentgen rays	Light	2	2	0	0
	Menopausal	3	3	0	0
Radium	360 to 780 mg. hr.	6	4	1	1
	Menopausal	5	2	0	3
Totals		16	11 (69 per cent)	1 (6 per cent)	4 (25 per cent)

Two of the 5 patients (Table III) who received roentgenologic treatment were given a light dose of roentgen rays, the so-called stimulating dose. This light dose was given over the pituitary gland in one case and over the ovaries in the other, with relief of pain for six months in both cases, at which time the treatment was repeated, again with relief. Because of the danger of too heavy exposure, this method of treatment should be used very cautiously and only by roentgenologists of experience. Three patients aged twenty-six, thirty-seven, and forty-three years, respectively, had a satisfactory menopause following a menopausal dose of roentgen rays.

A number of years ago one of us (L. J. S.) observed that temporary cessation of menstruation subsequent to the uterine application of a small amount of radium was followed by reestablishment of the menstrual cycle without pain although previously menstruation had been accompanied by severe pain. As a result of this observation, 11 patients of this series (Table III) were given intrauterine radium treatment, 6 receiving a small dose. Of these, 3 received 360 mg. hr. and 3, 400,

450, and 780 mg. hr., respectively. These patients were carefully selected and were given the radium only after other means had failed to give relief. One patient, aged thirty-five years, who received 450 mg. hr., ceased to menstruate after three and a half years of painless regular periods. Normal menstrual periods were resumed without pain in three other instances. Irregular menstruation, but accompanied by very little pain, occurred in one case and in one instance the patient continued to have dysmenorrhea. The 5 patients who were given what was considered a menopausal dose of radium were aged thirty-two, thirty-six, forty-two, forty-two, and forty-six years, respectively, and received an average of 1,100 mg. hr. of intrauterine radium treatment. In only 2 cases did menstruation cease; in another, after eight months of amenorrhea, painful but regular menstruation returned. In one case, after six months of amenorrhea, painful irregular flow returned, continued for several years and then permanent amenorrhea appeared. This patient was forty-seven years of age when this report was written. The fifth patient reported that she was having very irregular and painful menstruation. The choice of the menopausal dose of radium was dictated in these 5 cases by several factors: the greater age of the patients, the presence of menorrhagia and the failure to control the dysmenorrhea by less radical measures.

For those patients who are incapacitated for one or more days every month and who have not benefited by medical and hygienic measures conscientiously followed for several months, resection of presacral nerves is to be considered. The results obtained at the Mayo Clinic by this procedure are not included in this study but have been reported by Counseller and Craig and by Adson and Masson, who obtained 100 per cent relief of pain in 9 cases, 95 per cent relief in 2 cases, and 75 per cent relief in 3 cases following the operation. Careful selection of patients should be made for this operation, especially with regard to the nervous stability. The nervous, high-strung girl is very likely to become more nervous and introspective and the family more concerned about the girl's invalidism following any surgical procedure.

COMMENT

Primary ovarian functional dysmenorrhea is an economic and social handicap for a considerable number of women and a review of the results of attempts to remove the cause of the pain is indeed cause for discouragement.

Nervous instability and lowered tolerance of pain may be contributing etiologic factors when the patient is a slender, studious girl who has esthetic tendencies and who shuns physical activity, but dysmenorrhea afflicts also the vigorous, athletic girl of excellent nervous stability. Much can be done to relieve the moderate dysmenorrhea by intelligent attention to psychic factors and by improving the general physical condition by systematic physical exercises and by control of constipation. More definite knowledge of the function of the various endocrine glands and of the rôle played by the hormones may throw light on the etiology of dysmenorrhea and thus offer means of controlling the pain.

Review of the cases which form the basis of this study discloses that the antispasmodics, such as benzyl benzoate, gave relief in 50 per cent of the cases. In about 50 per cent of those cases in which dysmenorrhea was associated with irregularity of the menstrual cycle the use of the estrogenic substances, emmenin, progynon and sistomensin, controlled the pain. For those patients in treatment of whom the more simple medical measures are ineffective, more radical measures must be considered rather than resorting to the use of opiates. Resection of the presacral nerves or small doses of radium or roentgen rays are to be carefully considered as means of obtaining relief for the patient when other methods have failed.

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CLINICAL OBSERVATIONS ON THE EFFECT OF 800 K.V. ROENTGEN RAYS IN UTERINE CARCINOMAS*

HENRY SCHMITZ, A.M., M.D., F.A.C.S., F.A.C.R., CHICAGO, ILL.

(From the Department of Gynecology, Loyola University School of Medicine, and the Mercy Hospital Institute of Radiation Therapy)

FROM May 15, 1933, to June 1, 1934, eighty-nine patients with carcinomas of the female generative organs were admitted to the Mercy Hospital Institute of Radiation Therapy. Seventy-eight carcinomas were treated with 800 K.V. roentgen rays. The time elapsed in these cases since the termination of the treatment, therefore, has been from twenty-four to thirty-six months. It is too early to report permanent or absolute cure rates, which must be based on a survival rate of the conventional five years. However, a survey of the clinical results at this time may enable one to form a relative opinion on the therapeutic efficacy of 800 K.V. roentgen rays in comparison with that of 200 K.V. roentgen rays which are at present almost universally employed in the so-called combined method of radiation treatment with radium and roentgen ray in uterine carcinomas.

The objects of this report are twofold, namely to present the early local effects and the constitutional reactions produced with the therapeutic use of 800 K.V. roentgen rays. A discussion of the technical and physical details has been omitted. Those interested in these phases of radiation therapy are referred to the literature.[1]

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THE LOCAL RESULTS OF TREATMENT

The early local effects of radiation therapy coincide with the survival rates attained at the end of thirty-six months, which are tabulated in Table I. The carcinomas are divided into primary and recurrent. These main divisions are again subdivided into four clinical groups, namely:

Clinical Group I: The *clearly localized* carcinoma;
Clinical Group II: The *doubtfully localized* carcinoma;
Clinical Group III: The *invading growth;* and
Clinical Group IV: The *terminal or fixed growth.*

The clearly localized growth should not be larger than 1 cm. in diameter, and the uterus should be normally movable. The doubtfully localized growth may involve almost one-half of the vaginal portion of the cervix, but it apparently is still limited to the uterus, which, however, is not normally movable due to loss of elasticity of the paracervical tissue from inflammatory or neoplastic changes. The invading growth is characterized by an invasion with cancer of the parametria, constituting the suspension apparatus of the generative organs. The tumor mass as such is movable, but movability is restricted. The terminal carcinoma means a fixed tumor due to a frozen pelvis, or an invasion of the vaginal walls, the urinary bladder, or the rectum, or the formation of distant metastases.

The results of treatment are designated as arrested or not improved. If symptomatic or anatomic healing ensued, determined by follow-up examinations at monthly intervals, then the tumor was considered arrested in growth. If the patient succumbed, or the tumor remained active, or the patient did not report for follow-up, then the tumor was not improved.

TABLE I. RESULT OF TREATMENT

CLINICAL GROUP	NUMBER	ARRESTED	NOT IMPROVED	NUMBER	ARRESTED	NOT IMPROVED
I	1	1				
II	5	4	1			
III	14	9	5	8	3	5
IV	10	3	7	40	8	32
Total	30	17	13	48	11	37

There were three stump cancers in the primary and five stump cancers in the recurrent carcinomas, that is 10 per cent. The percentage of arrested primary cancers is 56.67 and of arrested recurrent cancers 22.92.

These values without any other qualification would be of only minor importance. However, their significance is enhanced compared with similar percentages of local results obtained in the radiation treatment of cancers subjected to different technics, that is with radiations of different qualities or lower voltages. Four periods have been studied in

the clinic. The factors of the technic of each period are shown in Table II. The cases admitted during one year of each period were taken and then divided according to the results of treatment at the end of eighteen months (see Table III).

TABLE II

PERIODS	RADIUM MG. EL. HR.	ROENTGEN K.V. MAX.	F. S. D. CM.	FILTER IN MM. AL.	FILTER IN MM. CU.	FILTER IN MM. SN.	FIELDS SIZE AND NO.	FIELDS SIZE AND NO.	H. V. L. IN MM. CU.	R. IN AIR
1914 to 1921	3600	90 to 140	30 to 65	10.0 or 1.0	0.5		25 or 225	9 to 14 or 2 to 4	0.5	675
1921 to 1925	3600	200	65	1.0	1.0		300	2 to 4	1.58	900
1926 to 1932	3600 to 4800‡	200	65	1.0	1.0		300	2 to 4		1375*
				1.0	2.0				1.94	1800†
1933	1200	800	70	3.0	4.5	1.56	300	2 to 4	8.80	3000†

*Five fraction doses each of 275 r. every other day to each field.
†Ten fraction doses one every other day to each field.
‡Three fraction doses each 1,500 to 1,600 mg. el. hr. in eight-day intervals.

TABLE III. RESULTS OF TREATMENT AT THE END OF EIGHTEEN MONTHS

	PRIMARY			RECURRENT		
YEAR	NUMBER	ARRESTED	NOT IMPROVED	NUMBER	ARRESTED	NOT IMPROVED
1914	22	5	17	10	0	10
1921	37	11	26	9	2	7
1926	19	7	12	2	1	1
1933	30	17	13	48	11	37

The percentages of survivals after eighteen months in the primary cases were 22.7 per cent in 1914; 37.8 per cent in 1921; 36.84 per cent in 1926; and 56.67 per cent in 1933. The absolute curability percentages in these periods were 14.70 in 1914; 26.77 in 1921; and 30.92 in 1926. Hence the ratio between the preliminary results at the end of eighteen months and the absolute curability rate is as follows:

TABLE IV. RATIOS BETWEEN THE PRELIMINARY AND FIVE-YEAR CURE RATES

PERIOD	PRELIMINARY RATE AT 18 MONTHS	ABSOLUTE CURABILITY	RATIO
1914	22.7	14.7	3 : 2
1922	37.8	26.77	4 : 3
1926	36.84	30.92	6 : 5
1933	56.67	?	?

These ratios may be applied to the preliminary results obtained with 800 K.V. roentgen rays. It has been our observation that the five-year cure rate increased invariably with an improvement in the quality of roentgen rays, as the radium dose remained practically the same. The difference in treatment between the periods of 1922 to 1925 and 1926

to 1933 has been in the time spacing; during the period 1922 to 1925 the entire treatment was completed within seven days and during the period 1926 to 1933 within twenty-one to twenty-eight days. The time spacing permitted an increase in the total radiation dose used in the 1922 period of about 35 per cent. The five-year cure rate was increased 4 per cent.

Should the ratios seen in Table IV prevail then the 56.67 per cent would be reduced to about 35 per cent if the first period ratio prevailed; to about 40 per cent if the second-period ratio proved effectual; and to about 45 per cent if the third-period ratio were applied. I do not wish to make predictions or to be speculative. The results attained under similar conditions in the previous periods justify the statement that the five-year curability rate should improve as the preliminary subjective and objective results have improved formerly with an increase in the voltage or a decrease in the wave length of the roentgen rays.

The results of treatment in the recurrent carcinomas are negligible from a curative viewpoint; but noteworthy from a palliative standpoint. Results should become improved if the surgeon would refuse to operate without preoperative, adequate radiation treatment or would refer the patient for adequate radiation treatment immediately after operation. A perusal of the allotment of the recurrent carcinomas to the clinical groups reveals that patients came late usually during the terminal stage. A recurrent carcinoma should not be treated until the clinical diagnosis has been corroborated by a histologic diagnosis. This is especially important in carcinomas recurrent after radiation treatment. The ulceration may be carcinomatous or inflammatory due to radiation necrosis. A repetition of the radiation treatment when radiation necrosis is present would then be directly disastrous.

The palliative results obtainable with 800 K.V. roentgen treatment are at times remarkable. Palliation is especially seen in carcinomas causing pelvic pain due to invasion of or pressure on the pelvic sensory nerves or to edema of the legs from lymph stasis by pressure of the fixed carcinomatous infiltrations on the blood and lymph vessels or obstruction of the ureters by invasion or by compression. Such palliation is mostly seen after the application of about 50 per cent of a tolerance skin dose to the midpelvis. This dose measures about 1,500 to 1,800 r. without backscatter in the midpelvis. Pelvibimanual examination reveals then a softening of the indurated tissues or a return of mobility of the tumorous masses. If objective or subjective improvement is not attained after the application of one-half of the total dose, then the outlook for an arrest of the primary cancer or a relief from parametrial invasion or compression of nerves, blood vessels, or ureters is probably very poor.

The sequence of the local reactions was as follows: Palliation of pain and total arrest of bleeding occur with the onset of reduction in the size of the tumor and appear about the midperiod of the treatment.

Absorption of the growth would be completed within two to six months. The rate of resolution depends on the size of the growth, on the amount of connective tissue cells in the growth, and the character of the tumor cells as radiation sensitivity, cell type, modification of the cells caused by previous radiations.

The local changes in the skin consist of epilation and erythema after a dose of about 50 per cent of the total dose, and exfoliation with a wet dermatitis at the termination of the treatment when the full dose has been given. The mucosae of the vagina, urinary bladder, and rectum assume a deep red color after about 50 per cent of the total dose has been applied and a white pseudodiphtheritic mucositis at the end of the treatment. The deep red discoloration reaction is accompanied by frequent and painful urination and diarrhea. The skin and mucosa reactions subside within four to six weeks. The tanning of the skin is negligible, and the hair regrows invariably.

GENERAL CONSTITUTIONAL REACTIONS

So-called radiation sickness as nausea and vomiting is hardly ever seen, though anorexia may become troublesome in the latter half of the course. It probably results from an alkalosis. The pH determinations of the blood are being undertaken, but a conclusion has not as yet been reached.

Gain in weight and strength may occur during the course of treatment coincident with the cessation of bleeding, ulceration, infection, and toxemia. It, however, may run a slow course after the treatment, coinciding more nearly with the gradual response of the tumor to radiation. Gain in weight and strength is a favorable prognostic omen; loss of the same is usually a sign of the continuance of the destructive ravages of the cancer.

Blood examinations[2] have been made routinely and at stated intervals. The erythrocyte count, hemoglobin percentage, leucocyte and differential count have been determined before the beginning of treatment and after the fifth, tenth, twelfth, fourteenth, eighteenth, and twentieth treatments in 60 consecutive cases. Significant decreases in the erythrocyte count (300,000 or more) occurred in only 10 cases, and were practically always associated with far-advanced malignant disease. In six instances there was a definite increase in the number of erythrocytes during the course of treatment. The remaining cases showed no significant changes.

Changes in the erythrocyte count were usually but not always accompanied by a corresponding change in the percentage of hemoglobin. In three cases, the hemoglobin percentage fell 10 to 15 points without any decrease in the erythrocyte count.

Changes in the leucocyte count occurred more frequently and were more pronounced than the changes in the erythrocyte count or hemo-

globin. The leucocyte count dropped to or below 4,000 in 21 cases. In 19 of these cases, the leucopenia was very transient and the differential counts remained normal. Only two instances of stubborn leucopenia were observed and these were both associated with multiple metastases to the bones.

These observations may be summarized as follows:

1. There is early relief from subjective symptoms such as pain, distress, discharge and bleeding, which is evident at about the midperiod of the treatment, that is from the fifteenth day on, as the course is extended over four weeks. The relief is permanent with an arrest of growth, and the symptoms reappear with a recurrence.

2. The systemic reactions are mild. Nausea, vomiting, and loss of appetite are infrequent. This is very apparent to one familiar with medium voltage therapy, i.e., 180 to 220 K.V. maximum. At the onset of the skin reaction and mucositis, symptoms referable to these complications arise, as burning and itching of the skin, frequent and burning urinations, and frequent watery and mucous stools. They appear about the twenty-first day, reach a climax at about the fifth or sixth week, and then gradually abate until complete healing has occurred at about the seventh to eighth week.

3. The effect on the growth is seen early. If no decided reduction in size of growth occurs at about the twenty-first day, then it may be assumed that total arrest or resolution of the growth will usually not occur.

4. The effects on the normal tissues of the skin and mucous membranes are erythema, epilation, exfoliation and secretion in the former, and erythema, pseudodiphtheritic mucositis, and watery and mucous discharge in the latter. They disappear at about the sixth to seventh week. The hair regrows almost invariably, the tanning is slight, and healing is seen by the end of four to eight weeks. Induration of the skin is not seen. If the general health of the patient had not been unduly lowered, as seen in advanced and infected cancers, the effect on the blood count did not show any marked reduction in the number of red and white cells or the percentage of hemoglobin.

5. The early results of treatment at an interval of twenty-four to thirty-six months after completion of the radiation treatment are very encouraging. Should these results become modified at the end of five years in the ratios seen with technics employing 140 to 200 K.V. roentgen rays, then a marked increase in the five-year curability rate should be attained.

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25 EAST WASHINGTON STREET

ON THE OBSTETRIC MANAGEMENT OF PREMATURITY

CLARENCE H. INGRAM, JR., B.S., M.D., PITTSBURGH, PA.
(From the Department of Obstetrics, Western Pennsylvania Hospital.)

MEDICAL literature contains many studies of premature infants but, until the recent reports by Clifford from the Boston Lying-In Hospital,[2, 3] nearly everyone has considered the premature as essentially a pediatric problem. Capper[1] observed that the early and correct application of forceps did not increase the danger of intracranial hemorrhage. A few others compared the mortality with the cause of prematurity, but the Boston studies were the first to show the marked bearing of the type of delivery upon the mortality.

It has been the opinion of our department for some time that delayed delivery would markedly decrease the premature's chances for life. Therefore, in studying our records of prematurity at the Western Pennsylvania Hospital, particular attention has been paid to the type of delivery and its relation to the infant's survival. That this report confirms our opinion is incidental. The essential fact remains that entirely too great an emphasis has been placed upon the problems of feeding and nursery care, at the expense of an almost utter neglect of the most important problem, the conduct of labor.

During the period from June 1, 1924, to March 1, 1935, there were 10,396 deliveries in this hospital with 349 living premature infants, for an incidence of 1:29.7 deliveries. These infants suffered a gross mortality of 53.2 per cent, with 36.4 per cent during the first twenty-four hours and 41.8 per cent within the first forty-eight hours. With such a preponderance of the deaths occurring in the first two days, it behooves us to inquire into the causes of them, both immediate and remote.

Feeding and kindred nursing problems were handled in essentially the same manner during the entire period. We have felt that the use of an incubator or thermostatically controlled nursery does not justify itself, and so each baby is kept in a separate premature bed. Each bed has a compartment for the baby 18 inches deep, 42 inches long, and 32 inches wide. It is covered at the ends and sides by a double quilted pad containing pockets for hot water bottles. There is a rubber covered mattress on the bottom. A bath thermometer stays beside the baby so the nurse can keep the temperature at 90° F. by regulating the hot water bottles. Our experience has been that by placing the responsibility of controlling the temperature of the bed directly with the nurse, there has been a minimum of temperature variation. She knows that everything depends upon her, and is never lulled to a false sense of

security by an impressive maze of thermostatic controls. Before a premature baby is born, one of these beds is prepared in the nursery and taken to the delivery room so that the baby is never chilled.

It should not be necessary to emphasize the value of breast milk to infants in general, and above all to prematures. Suffice it to say that, whenever possible, these babies were fed wholly upon breast milk. Lacking mother's milk, the entire feeding, or the necessary balance, was a modified cow's milk formula. Feedings were begun when the baby was six hours old and repeated at two-hour intervals until sufficient was taken to allow the infant to change to a three-hour schedule and continue to gain weight. Depending upon the strength of the individual infant, it was fed either by gavage, Breck feeder, bottle, or direct nursing at the breast.

The only addition to the above general outline is that for the past four years we have been administering fresh citrated blood to small or delicate babies. Our purpose is to reduce the tendency to hemorrhage and to supply an easily assimilable food, where a baby is not eating well or is markedly jaundiced. The blood is taken from either parent, or from another healthy donor, without typing. It is given within an hour or two following the delivery and repeated in from twenty-four to seventy-two hours, if the condition of the baby indicates it and the previous injection has been absorbed. The blood is given in the back, intramuscularly, from 15 to 50 c.c. in amount. Unfortunately we have no adequate data on this particular procedure; yet while no definite conclusion can be drawn, we are of the opinion that it is a very definite benefit.

Since these babies are placed in heated beds at birth, they are never chilled. All feeding is done by expert graduate nurses. Of course, the very immature infants, incapable of a separate existence, will succumb very quickly. But can we blame nursery care and immaturity entirely for the heavy mortality seen in the first forty-eight hours? Possibly, but not without looking for and ruling out all other factors beforehand.

What other factors should we consider? Let us examine the sex, the birth weight, the cause of prematurity, the cause of death, and last, the type of delivery.

Sex seems to have only a slight influence, with the mortality among the males being 54.1 per cent while that of the females was 51.4 per cent. This difference of less than 3 per cent does not indicate a great deal, and so we feel that sex is, at best, a negligible factor in this study.

On the other hand, the weight has a very marked bearing upon the mortality and would seem to be our best prognostic criterion. From Fig. 1 we learn that as the birth weight increases, there is a steady almost proportionate decrease in the death rate. Hence, other factors being equal, the larger the premature baby at birth, the better its chance of survival.

In studying the cause of prematurity and its bearing upon the mortality, we can consider only those cases with definite or apparent findings. In this series there were 191 of such, divided among four major groups.

The largest group of known causes (21.7 per cent) was that attributed to a multiple pregnancy. Of 75 babies in this group, 23 (30.6 per cent) died, giving to the group the lowest mortality. Toxemias of pregnancy resulted in 34 babies or 9.7 per cent of the total, with a mortality of 41.1 per cent. This small group can be subdivided into 13 who went into spontaneous labor with a mortality of 38.4 per cent, and 21 in whom labor was induced by artificial rupture of the membranes with an infant death rate of 42.8 per cent. There were 56 cases where the only apparent cause of premature labor was a spontaneous rupture of the membranes and of them we lost 46.4 per cent. Of 25 babies whose prematurity was attributed to maternal bleeding the mortality was 84.6 per cent. They were subdivided, with 8 spontaneous labors and a loss of 75 per cent and 18 where labor was induced with a mortality of 88.8 per cent.

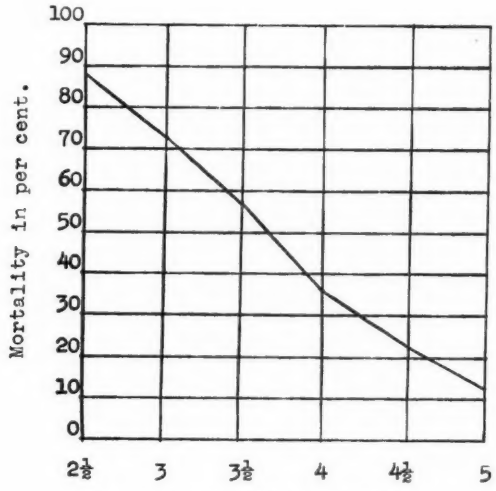

Fig. 1.—Birth weight in pounds.

In this series, multiple pregnancy gives the lowest mortality while the spontaneous group comes next. The maternal toxemia group is small and the difference in results between spontaneous and induced labor is very slight. Therefore, in spite of our figures to the contrary, we feel that where the mother's toxemia is not quickly controlled, and the baby is apparently viable, its chances of survival are enhanced if labor is induced by simple rupture of the membranes. Maternal bleeding, for obvious reasons, yields the highest infant mortality. Even though born alive, such babies have suffered more or less intrauterine asphyxia so that, even without the extra birth trauma, they are extremely likely to develop cerebral hemorrhage. This brings us to a consideration of the cause or causes of death among premature infants.

With nearly four-fifths of our total mortality occurring within forty-eight hours of delivery, it would seem that feeding and nursery care

are, at best, of secondary importance. Not that we wish to minimize the value of either, for both are decidedly essential. Rather, we must admit that most of the deaths occur before either of these factors has had time to be of any material influence. Unfortunately our records are based, to a large extent, upon the clinical diagnosis with very few autopsies to give pathologic support. According to these records, cerebral hemorrhage accounted for only 9 (4.7 per cent) of the 186 deaths. Atelectasis caused an equal number, while asphyxia is credited with 6 (3.2 per cent). By far the greatest number, 145 or 77.9 per cent of the total, was attributed only to prematurity. In contradistinction to this, Hess[4] has reported on 307 premature deaths of which 246 were autopsied. Of these latter, 107 or 43 per cent were definitely proved to have an intracranial hemorrhage. On the basis of this report, it would appear that our incidence of 4.7 per cent is far too low, and that intracranial hemorrhage should be considered as the major cause of death in premature infants. This being the case, we should find that the lowest mortality would be found following the least traumatizing labor and that the converse would also be true.

Therefore, let us consider the types of delivery and see if any significant facts may be learned. Of 52 forceps deliveries, 17 or 32.6 per cent died, yielding the lowest mortality for any type of delivery. As a contrast, we find 203 spontaneous live births with a loss of 113 or 55.6 per cent and, while this is second only to the forceps cases, it is already higher than the total gross percentage. In third place we have the group of 23 versions with a loss of 13 or 56.5 per cent, while in 51 breeches there was a mortality of 35 or 57.3 per cent. These percentages are very slightly higher than those shown in spontaneous deliveries and, we feel, should argue convincingly for reducing the time of labor. If the length of labor were the only factor, then cesarean section should show us the best record of all but, strange to say, this is not the case. In our series of ten sections we lost 80 per cent of the babies. This being even higher than that reported by Clifford,[2] we heartily agree with his conclusion that, "The present technic of cesarean section is one of the most hazardous methods that can be used for the delivery of premature infants." He suggests that this might be due to the preoperative use of morphine. Since we never use this drug prior to delivery of the baby in cases of cesarean section, we must look elsewhere, for morphine certainly cannot be the cause of our high mortality.

Can we attribute the mortality to the same cause which was our indication for cesarean section? Let us review these cases to see if there is anything to serve as an explanation. Three cases were repeat sections done because labor began prematurely, and all the babies were lost, as was one in the case of an elective section for a generally contracted pelvis. Two cases of mitral valvular disease were sectioned. The first baby died of cerebral hemorrhage. The second patient had twins, one

of which died in two days, while the second died on the ninety-eighth day of malnutrition. In two cases of placenta previa, one baby died in five hours, while the second survived, and in one case of cervical carcinoma the baby also survived. Three babies weighed over four pounds and two of them survived. Thus it would seem that a baby under four pounds has only a slight chance of survival. One indication for the operation is about the same as another and the small babies can rarely survive. Since there is no birth trauma, and since we do not use morphine preoperatively, the one common factor remaining would seem to be the inhalation anesthetic given the mother. The anesthesia is more prolonged for a section than for a forceps delivery. This may account for the heavy mortality or it may not, but it might be worthwhile to try a few such cases with spinal or local anesthesia, by way of comparison.

SUMMARY

1. With over four-fifths of our total premature mortality occurring within forty-eight hours of delivery, we must look to other factors than feeding and nursery care to account for it.

2. As the birth weight increases, so do the chances for the infant's survival.

3. Multiple pregnancy and maternal toxemia give us the best results among the known causes of premature labor, while antepartum bleeding acts as the greatest cause of infant death.

4. Forceps delivery offers the best method for handling premature labor and cesarean section, as now done, the worst.

CONCLUSION

The subject of prematurity warrants further study from the obstetric viewpoint. The method of delivery is a tremendous factor in the ultimate outcome of these infants.

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902 Peoples East End Building

Ozaki, M.: A Histologic Study of the Peripheral Nerves in the Human Female Genitalia, Jap. J. Obst. & Gynec. **19:** 2, 1936.

In an extensive investigation of the nerve distribution of the uterus, contrary to general opinion, Ozaki found nerve elements in fibromyomata of the uterus.

J. P. Greenhill.

POSTOPERATIVE URINARY TRACT SEQUELAE IN TOTAL HYSTERECTOMY

A Cystoscopic Study of 200 Cases

Ralph W. Eddy, M.D., Cincinnati, Ohio, and
Fred. H. Miller, M.D., Dayton, Ohio
(From the Department of Obstetrics and Gynecology, Western Reserve University and the University Hospitals)

IT IS the generally accepted belief among surgeons that trauma to the bladder and ureter is a common and serious complication in total extirpation of the uterus. Bland lists five types of total hysterectomy as the five most frequent causes of ureteral injury. Many articles have appeared to substantiate this claim. All have been based on proved cases appearing in a series of hysterectomies, and their conclusions are incontestable.

Injury is not always recognized at the time of operation. A fatal peritonitis may result from an unnoticed rent in the bladder with the escape of urine. Complete anuria or the presence of hematuria may reveal ligation or other injury to the ureter. The appearance of vesical or ureteral fistula may be the first notice of operative injury. Still later manifestations may be hydronephrosis, pyonephrosis, or complete atrophy of the kidney, often with no warning symptoms for months after operation. Bladders of small capacity may result from the attachment of the vesical peritoneum to the reconstructed pelvic sling made by suturing together the broad ligaments after hysterectomy. These patients complain of urinary frequency and urgency and are often believed to have cystitis or trigonitis.

Much has been said about ureteral injuries discovered after operation. It is generally believed that many are never recognized.

Harris reports a case in which serious symptoms did not occur until nine years after the operation. Newell states that there are no definite symptoms in unilateral ligation of the ureter and that death of the kidney occurs before the ligature is absorbed. Bland, in a comprehensive review of the literature, collected 316 cases of surgical injury of the ureter. Personal communications from 51 other surgeons yielded an additional 125 cases. Bland says, "Despite prevailing belief that ureteral damage is rare, I believe it to be one of the most, if not the most frequent, as well as the most serious accidents of pelvic work. . . . No doubt a certain number of ligations occur which are never recognized and which do not provoke symptoms though kidney destruction is inevitable." Morris and Brunton, speaking of traumatism to the ureter, say, "The effects may not be observed immediately and in the majority of cases they are not. The patient may go for months or perhaps years without any operative lesion being discovered."

Our attention was drawn to this problem by a patient, Florence E., forty-seven years old, colored, who was operated upon July 11, 1934,

by one of us. A perineorrhaphy, abdominal panhysterectomy, bilateral salpingo-oophorectomy, and appendectomy were done. The postoperative course was entirely uneventful. Maximum temperature was 38.5° C. There were no urinary symptoms. The patient was discharged on the twelfth postoperative day in good condition. Four weeks after operation a watery vaginal discharge was noted. Investigation revealed a ureteral stricture and a ureterovaginal fistula on the right side 4 cm. above the ureterovesical orifice.

This case suggested to us that such injuries with an asymptomatic latent period might indeed be more frequent than we realized. We were unable to find in the literature any adequate study to prove this generally accepted belief. We, therefore, instituted cystoscopy with ureteral catheterization and microscopic examination of the urine from bladder and ureters as a follow-up procedure to determine the effect of operation on the urinary system.

Two hundred patients who had undergone total hysterectomy, either by the abdominal or vaginal route, were studied. They were accepted without reservation if they had previously had a panhysterectomy in our department and would submit to cystoscopy. The investigation was begun in December, 1934, and continued for eight months. The patients were secured from the operative follow-up clinic in gynecology. While some patients declined cystoscopy none were encountered with evidence of serious urinary tract lesions that are not included in this series. The patient with ureterovaginal fistula and stricture, previously mentioned, was not included because the diagnosis was made four months before this study was begun.

The series studied comprised 187 abdominal panhysterectomies, 2 radical abdominal panhysterectomies (Wertheim), and 11 vaginal hysterectomies. With the exception of 4, all were performed by the house staff. Fourteen operators in all participated. Eight of the staff did 5 or less each, 4 did 6 to 25, and 2 did 26 to 80.

The ages of the patients were classified, though there is no particular reason why age should influence injury. It was found that the greatest number, 95, were in the fourth decade of life at the time of operation (Table I). This is in accord with the observation that most major gynecologic procedures are necessary in the late childbearing age.

TABLE I. AGE OF PATIENTS

1. 21-30	35—17.5%
2. 31-40	95—47.5%
3. 41-50	56—28.0%
4. 51-60	13— 6.5%
5. 61-70	1— 0.5%

Table II lists the major indications for operation. Benign tumors of the uterus lead the list with 96. Inflammatory disease of the adnexa, with 10, is low as a primary indication, but many others presented inflammatory changes though listed under other indications. Injuries of parturition as the chief indication in 70 patients

appears to be a large number. However, marked relaxation of the perineum with injury and infection of the cervix and malposition of the uterus is an important indication for perineal repair and panhysterectomy in the University Hospital Clinic. This, of course, applies to older women who have adequate sized families or are past the child-bearing age.

An analysis of the types of operation done reveals that panhysterectomy alone occurred only 16 times. In all others total hysterectomy was combined with removal of one or more of the adnexa, some type of perineal plastic, or both. All vaginal hysterectomies had adequate perineorrhaphies after reapproximation of the uterine supports and repair of the cystocele. Types of operation are classified in Table III.

Cystoscopy was performed at any time after the six weeks postoperative period. Two-thirds of the entire series were performed in the interval of two to twelve months after operation. The longest interval between operation and cystoscopy was four years and seven months (Table IV). We believe the large number of patients showing residual cystitis (Table VI) is due to the relatively short period between postoperative catheterization and cystoscopy.

TABLE II. MAJOR INDICATIONS

1. Injuries of parturition	70—35.0%
2. Inflammatory disease of adnexa	10— 5.0%
3. Ectopic pregnancy	2— 1.0%
4A. Benign tumors of uterus	96—48.0%
4B. Benign tumors of adnexa	7— 3.5%
5A. Malignant tumors of uterus	3— 1.5%
5B. Malignant tumors of adnexa	3— 1.5%
6. Other indications	9— 4.5%

TABLE III. TYPE OF OPERATION

1. Vaginal hysterectomy plus adnexa	1— 0.5%
2. Vaginal hysterectomy	10— 5.0%
3. Abdominal panhysterectomy alone	16— 8.0%
4. Abdominal panhysterectomy plus plastic	70—35.0%
5. Abdominal panhysterectomy plus adnexa	54—27.0%
6. Abdominal panhysterectomy plus plastic and adnexa	47—23.5%
7. Radical abdominal panhysterectomy (Wertheim)	2— 1.0%

TABLE IV. RELATION OF CYSTOSCOPY TO OPERATION

1. Under two months	25—12.5%
2. Two to six months	80—40.0%
3. Six to twelve months	56—28.0%
4. One to two years	31—15.5%
5. Over two years	8— 4.0%
(Longest interval 4 years 7 months)	

It is well known that lesions of the uterus and adnexa, as well as relaxations due to parturition, are frequently accompanied by urinary symptoms. A study of the history before and after operation reveals an interesting difference in cardinal symptoms. It will be noted in Table V that there was a small but constant reduction in all types of urinary symptoms after operation, although the tendency to infection due to postoperative catheterization is well known. And a comparison

of the number with no postoperative symptoms (Table V) and normal findings on cystoscopy (Table VI) is striking. One hundred forty-five had no symptoms postoperatively and 138 had normal urinary tracts as determined by cystoscopy.

TABLE V. PREOPERATIVE AND POSTOPERATIVE SYMPTOMS

	PREOPERATIVE	POSTOPERATIVE
1. Dysuria	16.5%	11.5%
2. Frequency and urgency	31.0%	21.0%
3. No symptoms	58.5%	72.5%
4. Incontinence	6.0%	3.0%
5. Retention	2.0%	—

TABLE VI. FINDINGS ON CYSTOSCOPY

1. Pyelitis	5— 2.5%
2. Cystitis and trigonitis	35—17.5%
3. Normal	138—69.0%
4. Atony of bladder	15— 7.5%
5. Foreshortened bladder	4— 2.0%
6. Angulation of ureter	3— 1.5%
7. Stricture of ureter	1— 0.5%

All cystoscopic examinations were done in the out-patient department except four that were subsequently admitted for pyelography. No. 21 F. Brown Buerger cystoscopes and No. 5 whistle tip ureteral catheters were employed. Spasm was encountered in 14 cases. Later attempts were successful in 10. Four patients had intravenous pyelograms to rule out stricture. Of these, 3 were normal. One showed a partial obstruction at 5 cm. above the ureterovesical orifice on the left and moderate hydronephrosis. This probably constitutes a ureteral stricture due to operative trauma though a preexisting stricture cannot be ruled out.

We have been impressed by the occasional patient who returned to the follow-up clinic after hysterectomy complaining of urinary frequency and urgency and occasionally of dysuria in whom no evidence of cystitis or urethritis could be found. On cystoscopic examination these patients presented foreshortened bladders with more or less marked lateral bulging. This condition, we believe, results from scar tissue formed under the vesical peritoneum used to cover raw areas. The bladder apparently cannot expand upward as it normally does and a bladder of small capacity is the result. Griffiths, and later, Morris and Brunton, mention various operations that interfere with the filling and ascension of the bladder, but do not describe this condition resulting from hysterectomy. We believe it to be a serious bladder injury, usually due to faulty operative technic and therefore preventable. Foreshortened bladder was encountered in four cases, an incidence of 2 per cent.

Another condition we have observed and have not previously found mentioned is a displacement of the terminal ureter so that it enters the bladder at an angle of approximately 90 degrees. This abnormal

angulation, we believe, is due to fixation of the ureter below the pedicle formed by mass ligation of the base of the broad ligament with the included uterine artery. Theoretically, it may produce hydronephrosis. This marked angulation was observed in three patients. None presented any evidence of hydronephrosis.

It is interesting to note that four patients had double ureters. Three were unilateral and one bilateral. The frequency of this congenital anomaly should be remembered by those doing pelvic surgery.

The sediments from vesical and ureteral specimens of urine were examined in every case. Pyelitis was found in five cases as evidenced by the presence of pus, in the ureteral specimen. Cystitis and trigonitis were determined by appearance of the bladder mucosa and microscopic examination of urinary sediment. Thirty-five patients presented this condition. None of these infections were extensive or acute. Believing these infections probably due to postoperative catheterization or the persistence of a preexisting cystitis, we found that in 25 of the 35 cases with cystitis, cystoscopy had been done within six months after operation, and that 15 were found within three months of operation. In the remaining patients with cystitis some stated that symptoms developed long after operation. These sequelae were probably not due to the operation.

Atony of the bladder was observed in fifteen cases as evidenced by abnormal capacity. This condition was probably present before operation, and due to injuries of parturition. It is possible that later cystoscopy would reveal a return to normal tone in some of these cases. The possibility of operative interference with the nerve supply is to be kept in mind, however.

Finally, 138 patients presented normal urinary systems as determined by cystoscopy and microscopic examination of the urine. This parallels closely the absence of symptoms referable to the urinary tract after operation.

SUMMARY

1. The various types of total hysterectomy are by far the most frequent causes of urinary tract injury.

2. Symptoms referable to injury may be mild or absent for a considerable period of time after operation.

3. Cystoscopic examination of 200 patients who had previously had some type of total hysterectomy was done to determine the incidence of urinary tract sequelae.

4. One patient was found to have a stricture of the terminal ureter with moderate hydronephrosis, and incidence of 0.5 per cent.

5. Four patients presented bladders of small capacity, probably resulting from operation.

6. Three cases with an abnormal angulation of the ureter, possibly due to operation, were found.

7. Fifteen patients showed evidence of atonic bladders.

8. Five patients were found to have pyelitis and 35 to have cystitis.

9. There was a small but constant decrease in all cardinal urinary symptoms after operation.

10. There is a striking analogy between the number having no postoperative urinary symptoms and the number of patients with normal urinary tracts as determined by cystoscopy.

CONCLUSION

We believe cystoscopic examination should be a routine part of the follow-up care in major pelvic surgery. This small series of cases indicates that ureteral or bladder injury is not necessarily a frequent complication of total hysterectomy.

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During the past four years Kovacs has observed 16 cases of gynatresia or stricture of which only 6 were congenital and 13 secondary. The latter type of strictures of the vaginal canal are due to (1) hormonal disturbances, (2) mechanical injuries, (3) chemical and thermic causes, (4) radiation therapy, (5) infections, (6) neoplasms, and (7) foreign bodies.

Hormonal disturbances may result not only in menstrual difficulties, sterility and menopausal troubles but also in local changes in nutrition which are followed by strictures of the vagina. Likewise, changes in the function of the glands of internal secretion may aid the formation of tumors in the genital tract. When neoplasms of unexplained origin are detected, we should think of hormonal abnormalities. The growths in the genital tract which are due to endocrine disturbances heal poorly unless specific therapy is applied. Scar tissue produces either partial or complete atresia of the genitalia. When endocrine therapy is instituted, healing is rapid and without scar formation. Induced abortion may produce atresias in the genital tract and these can be overcome only by extensive operations. The author warns against the indiscriminate application of radium for bleeding from the uterus not due to malignancy. Other forms of therapy applied to the mucous membranes should also be restricted.

The author advocates the use of hormones in all cases of ulcerative processes of the reproductive canal brought about by chemical, thermic, traumatic, or infectious processes, because such treatment will hasten healing and avoid scar formation.

J. P. Greenhill.

A STATISTICAL ANALYSIS OF THE RECORDS OF PRIMIGRAVIDAS OVER THIRTY-FIVE YEARS OF AGE

PAUL H. ROEDER, M.D., PHILADELPHIA, PA.
(From the Philadelphia Lying-In Hospital)

THIS study was undertaken to determine if possible, whether the apprehensions of most patients and some physicians about parturition in the later years of the childbearing cycle, undertaken for the first time, are borne out in actual practice. During the six and one-half years reviewed, there were delivered in the Philadelphia Lying-In Hospital, 13,246 patients. Of this number 113 were having their first labor at age thirty-five or older; an incidence of 0.85 per cent or one in every 117.2 patients. Twenty-two of the 113 were not strictly primigravida, there having been 25 previous pregnancies among them; three being pregnant twice; 21 of which terminated in abortion and 4 in miscarriage.

TABLE I

Philadelphia Lying-In Hospital July 1, 1929 to January 1, 1936			
Total patients delivered			13,246
Total primigravidas of 35 years or older (One patient in every 117.2)			113—0.85%
White	106	Private	78
Colored	7	Ward	35

Age.—Between the ages of thirty-five and forty there were 98 patients and between forty and forty-five, 15 patients, or a ratio of 6.5:1 in these two groups.

TABLE II. AGES

35 - 21	98	40 - 6	15
36 - 24		41 - 3	
37 - 20		42 - 2	
38 - 19		43 - 2	
39 - 14		45 - 2	

A complication of pregnancy was noted in 46 or 40.7 per cent of the group. Fifty per cent or half of these had signs or symptoms referable to intoxication or the cardiovascular system.

Labor was complicated in 31 or 27.4 per cent of the patients. The two complications of persistent occipitoposterior and floating head at term accounted for 20 or approximately 66 per cent of those so classified.

Puerperal complications occurred in 35 or 30.9 per cent of these mothers. Sapremia, breast engorgement or postoperative reaction was the complicating factor in 20 or 4/7 of those whose convalescence was not uneventful.

TABLE III. COMPLICATIONS OF PREGNANCY

46 patients—40.7%			
Contracted pelvis	6	Syphilis	2
Cardiac disease	5	Tuberculosis	1
Hypertension	5	Old fracture of pelvis	1
Toxemia	3	Deformed pelvis	1
Preeclampsia	3	Encephalitis lethargica	1
Mild toxemia	3	Psychosis	1
Polyhydramnios	3	Multiple myomectomy	1
Pernicious N. & V.	2	Uterine myomas	1
Edema	2	Placenta previa	1
Antepartum bleeding	2	Cervical polyp	1
		Pyelitis	1

TABLE IV. COMPLICATIONS OF LABOR

31 patients—27.4%	
Persistent occipitoposterior	10
Floating head at term	10
Failure cervical dilatation	3
Moderate postpartum hemorrhage	2
Arrest at midpelvis	2
Contraction ring	1
Disproportion	1
Placenta previa	1
Retained placenta	1

TABLE V. COMPLICATIONS OF PUERPERIUM

35 patients—30.9%			
Sapremia	8	Phlebitis	2
Breast engorgement	6	Cardiac decompensation	2
Postoperative reaction	6	Infected perineum	1
Hypertension	3	Toxemia	1
Pyelitis	3	Peritonitis	1
Bronchopneumonia	2		

Twenty-four patients had no labor, an elective cesarean section being performed before the onset of labor. Thirty-six had less than ten hours. Forty had less than twenty hours. Thirteen had labors in excess of twenty hours; the longest seventy-three hours twenty minutes, but doubtless in many of these the presence of rhythmic hard contractions was intermittent and not constant. The average length of labor for the entire group was eleven hours. Excluding the 24 who had no labor, the average was 13.9 hours.

Of the 116 infants, 103 were vertex presentations; 10 breech; 1 transverse, and 2 undiagnosed at the onset of labor. Occiput anterior in 59· transverse in 12; posterior in 18; and positive position unknown in 14.

Delivery was spontaneous in 8 labors; by forceps in 61, of which 44 were low forceps and 17 midforceps applications. Cesarean section was performed on 28 patients; internal podalic version in 10; breech extraction in 8; and the extraction of a transverse presentation in 1.

The combined operative incidence was 92.9 per cent.

TABLE VI

TOTAL NUMBER	HOURS LABOR	TOTAL NUMBER	HOURS LABOR
24	0	6	15+
1	2+	3	16+
6	3+	5	17+
4	4+	5	18+
8	5+	1	19+
1	6+	3	20+
8	7+	2	23+
3	8+	1	24+
5	9+	1	25+
4	10+	2	31+
6	11+	1	36+
4	12+	1	42+
1	13+	1	46+
5	14+	1	73+

Average (11 hours for 113)
(13.9 hours for 89)

TABLE VII. OPERATIVE INCIDENCE

105 patients—92.9%	
Forceps	52.2%
Cesarean	24.7%
Version	8.8%
Breech	6.1%

Episiotomy was performed 40 times; 1° laceration sustained 9 times; 2° laceration, 16 times; 3° laceration, 3 times.

TABLE VIII. LACERATIONS

1°	9
2°	16
3°	3
Episiotomy	40

TABLE IX. ANALGESIA

Nembutal and scopolamine		27
Morphine and scopolamine		18
Morphine		9
Sodium amytal		5
Barbital		2
Codeine		1
Nembutal and codeine		1
Scopolamine		2
Nembutal		1
None		45
Gwathmey	alone	2
	combined	6

Analgesia in one form or another was given to 68 patients; 45 of these women were allowed to continue spontaneously, unaided through the first stage of labor.

All but four of the deliveries were accomplished under anesthesia; of these, 2 were precipitate and 2 were at the end of three- and four-hour labors, with small infants weighing under four pounds.

TABLE X. ANESTHESIA

Ether	55
Gas ether	38
Gas	8
Gas oxygen	6
Chloroform	2
None	4

Twenty-eight elective cesarean sections were done, or an incidence of 24.7 per cent. Contracted pelvis, failure of the cervix to dilate, floating head at term in a primigravida, or cardiac disease, were the indications in 18 or 64 per cent of the patients.

TABLE XI. CESAREAN SECTION—28 OR 24.7%

Failure of cervical dilatation	4
Floating head in primigravida	4
Contracted pelvis	7
Cardiovascular disease	3
Elderly primigravida	3
Uterine myomas	2
Placenta previa	2
Toxemia	1
Tuberculosis; disproportion	1
Section and sterilization	1

In 113 pregnancies there were three sets of twins or a total of 116 infants. Of these, 112 were born alive and 4 were stillborn. Females predominated 65:51. Fifteen babies weighed under 5 pounds and five over 8 pounds. Six were premature.

TABLE XII

WT. OF INFANTS	TOTAL NUMBER
2 pounds plus	3
3 pounds plus	6
4 pounds plus	6
5 pounds plus	16
6 pounds plus	24
7 pounds plus	42
8 pounds plus	14
9 pounds plus	5

Twenty-nine mothers were morbid, or 25.6 per cent. Breast engorgement, postoperative reaction, sapremia, and pyelitis accounted for 22 or 75.8 per cent.

Two mothers in this series died, or 1.76 per cent; one from shock and cardiac failure following a version after eighteen hours of labor. Baby

weighed 7 pounds and 10 ounces. A severe 3° laceration was sustained in this delivery. The other died from postoperative peritonitis following an elective cesarean section, before the onset of labor.

TABLE XIII. MATERNAL MORBIDITY

29 patients—25.6%	
Breast engorgement	6
Postoperative reaction	6
Sapremia	7
Pyelitis	3
Bronchopneumonia	2
Infected perineum	1
Toxemia	1
Endometritis	1
Peritonitis	1
Phlebitis	1

TABLE XIV. MATERNAL MORTALITY

2 patients—1.76%	
Shock; cardiac failure	1
Postoperative peritonitis	1

Four infants were morbid or 3.45 per cent.

TABLE XV. FETAL MORBIDITY

4 infants—3.45%	
Prematurity and pneumonia	1
Dehydration	1
Spina bifida and hydrocephalus	1
Cause unknown	1

The combined fetal mortality rate was 8.62 per cent or 10 infants. Of these, 4 were stillborn; 4 were premature, and 1 was deformed. One died

TABLE XVI. FETAL MORTALITY

10 infants—8.62%	
Stillborn	4
Prematurity	3
Spina bifida and hydrocephalus	1
Breech, immature	1
Intracranial hemorrhage	1

TABLE XVII. COMPARISON OF THIS SERIES TO HOSPITAL IN GENERAL

	THIS SERIES	
Complications of pregnancy	40.7	18.6
Complications of labor	27.4	14.3
Complications of puerperium	30.9	21.6
Maternal morbidity	25.6	19.8
Maternal mortality	1.76	0.57
Fetal morbidity	3.45	
Fetal mortality { Uncorrected	8.62	6.4
Fetal mortality { Corrected	0.86	2.60

from intracranial hemorrhage following an "emergency" version delivery, forceps having failed. The preventable obstetric fetal mortality is therefore 0.86 per cent.

CONCLUSIONS

A comparison of this series of 113 patients with the total of 13,246 prompts the following conclusions:

1. Complications of pregnancy will occur considerably more often.
2. Complications of labor will be more frequent.
3. Complications of the puerperium will be encountered a trifle more often.
4. The operative incidence will and should be considerably higher than in the younger primigravida group.
5. The cesarean section incidence from five to six times as great.
6. Maternal morbidity 5 per cent higher.
7. Maternal mortality over three times as great.
8. Fetal mortality one-third as great.

THE EFFECT OF ARTIFICIAL PSEUDOMENSTRUATION AND MENSTRUATION ON THE INCREASED ELIMINATION OF PROLAN A IN THE ABSENCE OF OVARIAN FUNCTION

BERNHARD ZONDEK, M.D., JERUSALEM
HONORARY FELLOW, AMERICAN GYNECOLOGICAL SOCIETY
(From the Gynecologic and Obstetric Department of the Rothschild-Hadassah Hospital, Jerusalem)

IN 1930[1] I demonstrated the fact that there is an increased elimination of follicle-producing hormone in the urine in the absence of the ovarian function (more than 100 mouse units prolan A per liter). At that time I also showed an increased elimination of hormone in 13 out of 15 (i.e., in 86.6 per cent) castrated women between twenty and fifty-two years of age. Ten days after castration follicle-producing hormone is present in the urine. I could also demonstrate the existence of the same phenomenon during the period when the ovary normally ceases to function, i.e., at the climacteric. The latter has three differing hormonal phases, the last of them being the polyprolanal phase. If ovarian function stops in a woman of the procreative age, which is shown clinically by a long amenorrhea, this disturbance is characterized by an increased elimination of prolan A. These findings have been studied and verified by many authors.

In the following investigations, the question is whether the increased elimination of prolan A might be influenced by producing artificial menstruation. Examinations were made in cases of primary

amenorrhea, secondary amenorrhea, and in a young castrated woman. What is understood by the term menstruation and what is understood as artificial menstruation must be borne in mind. We have to distinguish between two kinds of bleeding: (1) Bleedings from proliferated uterine mucosa, and (2) hemorrhage from a mucosa in the progestive phase. The studies of American authors on the induction of uterine bleedings in monkeys may have brought about a little confusion. In the summer cycle of the female monkey there exists a periodical non-ovulating bleeding from proliferated mucous membranes. (Hartmann et al.) Similar cyclic hemorrhages also occur in the human female. In the latter instance the ovaries produce the follicular hormone only, but not the corpus luteum hormone. This bleeding must be classed as pseudomenstruation. Only the hemorrhage from a secreting mucous membrane, i.e., from a uterine mucous membrane on which the corpus luteum hormone (progesteron) has exerted its influence, can be called true menstruation. It is solely in a mucous membrane of this type that a fertilized egg can develop. As is well known, menstrual blood differs from ordinary blood by its inability to coagulate. If bleeding is induced in a castrated woman by follicular hormone (200,000 to 300,000 M. U.), this blood likewise does not coagulate according to my observations. This means that blood shows the same characteristics in pseudomenstruation as in true menstruation. On the other hand, the hormonal mechanism is very different in pseudomenstruation and menstruation. Therefore you cannot explain the mechanism of menstruation in a human female through data obtained on pseudomenstruation in monkeys.

In a castrated woman, it is sufficient to induce hemorrhage by administering follicular hormone, i.e., to produce a pseudomenstruation. With the beginning of the bleeding, the woman will lose her subjective complaints and she will see in the returning of the bleeding an expression of her regained female functions. However, in a case of amenorrhea in the procreative age, one should not be satisfied by producing pseudomenstruation only; moreover, folliculation and real menstruation should be induced in order to make conception possible. However, this result cannot be obtained by ovarian, but by gonadotropic hormones only. In such an instance therapy by hormonal substitution will not be sufficient, but we will need hormonotropic stimulation.

In the present studies I artificially induced uterine bleedings in amenorrheic women and in one castrated woman, and then analyzed the urine for prolan A.

To prove the presence of small amounts of prolan A, I formerly used the method of precipitation by alcohol.[2] Later on, together with Scheibler and Krabbe,[3] I demonstrated the method of precipitation by phosphotungstic acid and phosphomolybdenic acid, respectively. Katzmann and Doisy[4] use a similar method: precipitation by tung-

stic acid. However, the prolan values in the urine found by Katzmann and Doisy are lower than those I found by means of the alcohol precipitation method. Thus I cannot admit any superiority of the tungstic precipitation over the alcohol precipitation method. Precipitation by alcohol is simple and may be done easily in every laboratory.

In the following I wish to present in brief the cases under investigation:

SECONDARY AMENORRHEA

CASE 1.—M. Schw., twenty-eight years old, married five years, sterile. Menstruation started at fifteen years, almost regularly. Total amenorrhea for five years.

Urinalysis before treatment revealed at least 111 M. U. prolan A per liter morning urine.

From July 8 to 28, 1935, the patient received 10 injections of dimenformon* (benzoate dihydrofollicularhormone). Every injection contained 50,000 M. U., i.e., a total of 500,000 M. U. of dimenformon.

The reaction of the morning urine from July 29, at the end of the treatment with dimenformon, was negative and the 111 M. U. of prolan A per liter of urine was no longer demonstrable.

Nine days after stopping the dimenformon treatment, a bleeding occurred, lasting four days. Urinalysis during menstruation was also negative.

Result.—In this case, increased elimination of prolan A was no longer noticeable after treatment with follicular hormone.

CASE 2.—Ch. E., thirty-six years old, married twenty-two years. The patient had been married at fourteen, before her first menstruation. She began menstruating at the age of fifteen and one-half years, regularly in the beginning, then at an interval of two to three months. For five and one-half years she has been amenorrheic.

Analysis of the urine before treatment was positive, i.e., there were at least 111 M. U. of prolan A per liter of morning urine demonstrable.

From June 23 to July 11, 1935, the patient received 14 injections of dimenformon, a total of 700,000 M. U.

During the treatment, i.e., after administration of 600,000 M. U. of dimenformon, the prolan reaction was negative, i.e., 111 M. U. of prolan were no longer demonstrable. The treatment was ineffective; there was no bleeding.

In July and August, 1935, the patient received 700,000 M. U. of dimenformon for a period of twenty days. After that she received 5 rabbit units of progesteron daily from the twentieth until the twenty-fifth day. After stopping the treatment, there was menstrual bleeding. Urinalysis was again negative.

Result.—It was not possible to induce pseudomenstruation by administration of follicular hormone, but excessive elimination of prolan A was abolished. By a combined treatment with follicular and corpus luteum hormone, menstruation could be induced and simultaneously increased excretion of prolan A was abolished.

PRIMARY AMENORRHEA

CASE 3.—Ch. A., thirty years old, married thirteen years. She never menstruated. The uterus was hypoplastic, 4 cm. long.

On May 8, 1935, before the treatment began, the urinalysis was positive. There were at least 111 M. U. of prolan A per liter of morning urine demonstrable. With-

*I am indebted to the "Organon" factory (Oss, Holland) for supply of dimenformon.

in twenty days the patient received 8 injections of dimenformon, each containing 50,000 M. U., a total of 400,000 M. U. After this treatment, she was injected with 5 Rab. U. of progesteron daily from the twenty-first to the twenty-sixth day.

Analysis of the morning urine on the twenty-seventh day was positive. Thus this treatment did not decrease the elimination of prolan A.

Two days after the treatment a real menstrual bleeding began, lasting five days.

Result.—Combined treatment with follicular hormone and corpus luteum hormone induced menstrual bleeding. But it is not possible to influence increased elimination of prolan A.

CASE 4.—R. B., twenty-six years old, married five years. The patient never menstruated.

On April 1, 1935, before beginning the treatment, urinalysis was positive. There were at least 111 M. U. of prolan A demonstrable per liter of morning urine.

First treatment: From April 3 to April 22 the patient received 9 injections of dimenformon, a total of 450,000 M. U.

On April 23 urinalysis was positive; there were at least 111 M. U. of prolan A per liter of morning urine.

After this treatment, the patient received 5 Rab. U. of progesteron daily from April 23 until 26, a total of 20 Rab. U.

On April 26 the patient menstruated for the first time, the flow lasting four days. On the first day of the bleeding, one strip of mucous membrane was taken from the uterus with a special curette. Examination revealed a real premenstrual mucous membrane. The glands were rich in glycogen.

On April 29, the third day of menstruation, urinalysis for prolan A was again positive.

Second treatment: From May 2 to May 21 the patient received 9 injections of dimenformon, a total of 450,000 M. U. In addition she received 5 Rab. U. of progesteron from May 22 to May 26, a total of 25 Rab. U. On May 26 there was a menstrual bleeding again. On June 27, the second day of menstruation, urinalysis was negative, which means that 111 M. U. of prolan A were no longer demonstrable.

Result.—Though menstruation could be induced, it was not possible to decrease excretion of prolan A by administering dimenformon and a following treatment with progesteron, respectively. After the second treatment, i.e., during the second menstruation only, was elimination of prolan A decreased.

CASTRATA

CASE 5.—G., twenty-eight years old. She had been castrated because of bilateral tumors five years earlier. The patient suffered very much physically and psychically from the deficiency symptoms. The vagina was narrowed and pale; the uterus was hypoplastic, 4 cm. long. I observed the patient for a year. By hormonal treatment I succeeded in inducing bleedings at regular intervals. Her complaints stopped completely. During the first months (December, 1934 to March, 1935), bleeding was induced by a combined treatment with dimenformon and progesteron. Within twenty days the patient received 7 injections of dimenformon, a total of 350,000 M. U. During the next four days she received 5 Rab. U. of progesteron daily; two to three days later there was a regular menstrual bleeding which lasted three to six days.

In April and May, 1935, I was contented with inducing pseudomenstruation. Within twenty days the patient received 350,000 M. U. of dimenformon, and after seven days flow began. It is interesting to note that there was always a week's interval after the administration of follicular hormone and the beginning of the flow.

On June 9, 12, 16, 19, 23, 26, 29, 1935, respectively, the patient received one ampulla of dimenformon containing 50,000 M. U. Analysis of the morning urine of June 14, after administration of 100,000 M. U., was positive. That means, that there were at least 111 M. U. of prolan A per liter of urine demonstrable. A second analysis was made on July 3, three days after stopping treatment. This analysis, too, was positive. Besides prolan A, prolan B was also demonstrable. (111 M. U. per liter of urine.)

On July 6 occurred another bleeding. From July until December, 1935, there used to be bleeding, starting regularly seven days after closure of the treatment with dimenformon.

Result.—In a young castrated woman increased elimination of prolan A could not be impaired, though she was treated with hormones for seven months. Menstruation or pseudomenstruation, respectively, had been induced on seven occasions. In spite of the intensive treatment, no influence on elimination of prolan could be obtained.

DISCUSSION

Accompanying the loss of the ovarian function (primary and secondary amenorrhea, third stage of climax, castration) there is an increased elimination of prolan A in the urine. How can this be explained? When, during the climax, the ovarian tissues cease to function, prolan A loses its effect on the ovary and is unable to produce folliculin. This phenomenon might be explained by the fact that prolan A, having thus become useless, is now being excreted with the urine.

The following explanation seems to me much more essential. The gonadotropic hormones are superordinate sexual hormones. The ovary regulates the function of the anterior lobe of the pituitary by stimulation or by retardation. As I reported a short while ago elsewhere,[5] follicular hormone is able to inhibit important functions of the anterior lobe of the pituitary. It is easy to imagine that the anterior lobe, being deprived of its checking apparatus, would produce an excess of hormones which would be excreted with the urine. This opinion is supported by H. M. Evans[6] who proves that the pituitaries of castrated animals have a higher content of gonadotropic hormones. Possibly both causes cooperate, i.e., the absent working point for the gonadotropic hormone following loss of the ovarian function and the active hyperfunction of the anterior lobe of the castrate. To me, hyperfunction seems to be the more important cause.

A few years ago (1931),[7] I was experimenting to find whether this hyperfunction might be moderated. At that time we did not yet possess hormones in strong enough concentrations. I performed a homoplastic transplantation of ovarian tissue in a young castrated woman. The increased elimination of prolan remained uninfluenced by this operation. There was also no effect on the prolan excretion after subcutaneous or intravenous injections, respectively, totaling 15,000 M. U. of folliculin. It might be argued against these negative findings that neither ovarian transplantation nor folliculin administration (15,000 M. U.) was sufficient to exert a depressive effect on the

anterior lobe. It appeared necessary to administer large hormonal doses in order to regulate the function of the anterior lobe.*

I injected amenorrheic women with the quantities of hormones necessary to induce menstruation, i.e., 200,000 to 300,000 M. U. dimenformon during a period of twenty days, and 5 Rab. U. of progesteron daily during the following 5 days.

In the first case thus treated, the result was negative, i.e., the increased excretion of prolan A remained uninfluenced. I reported briefly on this fact in my book.[8] On continuing these studies I found that the regulation of prolan A elimination is different in proportion to the degree of ovarian dysfunction. In cases where the ovarian function has not yet ceased entirely, i.e., where menstruation had disappeared for a few years only, one may succeed in reducing the excretion of prolan A. In both cases of secondary amenorrhea, it was possible to reduce excretion of prolan A by a sufficient dose of follicular hormone. Before the beginning of the bleeding (pseudomenstruation), excretion of prolan A had already been influenced. In the second case, though we did not succeed in inducing any bleeding, the prolan A content of the urine was decreased.

The conditions are somewhat different in primary amenorrhea and castration, i.e., in cases where ovaries had never been functioning or the sexual glands had been removed. In Case 3 real menstrual bleeding had been induced by means of dimenformon and progesteron, but elimination of prolan A could not be decreased. Also in Case 4 the hormonal provocation of menstruation could not influence the elimination of prolan A. Only after the second treatment did we succeed in lowering the prolan A level in the urine. The castrated woman was treated with hormones for several months, and we regularly succeeded in inducing pseudomenstruation or menstruation, respectively, according to the method of treatment. But we did not succeed in influencing the increased excretion of prolan A.†

SUMMARY

1. The loss of ovarian function is characterized by an increased excretion of follicular hormone in the urine (more than 111 M. U. of prolan A per liter). The increased excretion is probably caused by hyperfunction of the anterior lobe of the pituitary in the absence of any inhibitory action of the ovary on the anterior lobe.

*The periodic ovarian cycle may, as I reported a short time ago, (Wien. klin. Wchnschr. 13: 455, 1936) be influenced by follicular hormone. If 100,000 M. U. dimenformon are injected into a woman of the procreative age during the sixth to twenty-fifth day of her cycle, menstruation fails to appear. That means that we have induced an artificial amenorrhea.

†In the meantime R. T. Frank and U. J. Salmon (Proc. Soc. Exper. Biol. & Med. 33: 311, 1935) succeeded in temporarily ameliorating the hypophyseal hyperactivity in 14 various cases of menopause. The authors injected from 4,000 to 22,000 R. U. estrogenic factor (divided in doses of 4,000 R. U. at intervals of 2 or 3 days) and observed a rapid decrease of gonadotropic factor in the blood and urine. The disappearance of the prepituitary hormone persisted for from 28 to 70 days but was regularly followed by a return to the condition of excretion noted before treatment.

2. An attempt was made to influence the increased prolan excretion by inducing pseudomenstruation or menstruation. This is successful in proportion to the severity of the ovarian dysfunction.

If the functional inhibition of the ovaries exists a few years only (secondary amenorrhea), elimination of prolan A can be decreased by administering the quantity of follicular hormone required for inducing pseudomenstruation.

If ovarian function has never been present (primary amenorrhea), even the induction of menstruation may not depress excessive elimination of prolan A. This is only possible after repeated induction of menstruation.

In the castrated woman, prolan A production will not be influenced even if pseudomenstruation or menstruation, respectively, could be induced for several months in succession.

3. The disturbance of the gonadotropic function of the anterior pituitary is not of the same kind in primary as in secondary amenorrhea. This is shown by the fact, that excessive production of gonadotropic hormones may be influenced by means of ovarian hormones in cases of secondary amenorrhea, but they are scarcely or not at all to be influenced in cases of primary amenorrhea.

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Young, James: Birth Control, Contraception and the So-Called Safe Period, Brit. M. J. **1**: 1091, 1936.

A steady decline in birth rate of most western communities during the past sixty years is ascribed in the main to the operation of intentional restriction of fertility. The author discusses three ways in which such restrictions are attained—abstinence, abortion, and contraception.

The safe period as formulated by Ogino-Knaus is described and criticism of it offered. From the practical standpoint it may be summarized that there exists evidence to suggest that if certain criteria are rigidly observed birth control based on the safe period can be employed with a reasonable measure of certainty. Where any variation in type exists, the difference in days between the minimum and maximum cycles is added to the beginning of the fertile period as based upon the maximum cycle. Adjustments may be required after childbirth, abortion, debilitating diseases or any drastic alteration in the routine ways of life.

Mechanical contraceptive methods are briefly outlined. The vaginal check pessary is recommended.

Birth control must be accepted by the profession as a procedure which comes within the purview of medical practice.

F. L. ADAIR AND S. A. PEARL.

EVIPAL SOLUBLE ANESTHESIA IN GYNECOLOGY*

HERBERT E. SCHMITZ, M.D., B.S., F.A.C.S., CHICAGO, ILL.

(From the Departments of Gynecology, Mercy Hospital and Loyola University School of Medicine.)

NUMEROUS operations and diagnostic procedures frequently used by the gynecologist in everyday practice require complete anesthesia for brief periods of time. General inhalation anesthetics, with their unpleasant sequelae, require costly apparatus, are difficult to administer, and necessitate the services of an expert anesthetist. For the past year, evipal soluble has been employed in our clinic in all patients requiring an anesthesia of not more than thirty minutes' duration. In a few instances it has been used as preliminary medication or for basal anesthesia in place of morphine and scopolamine or tribromethanol (avertin) premedication. The results have been most gratifying and for this reason I wish to report our experience in one hundred consecutive cases.

HISTORY

Evipal soluble is the soluble sodium salt of a new barbituric acid derivative: N-methyl-cyclo-hexenyl-methyl barbituric acid, first prepared by Weese[1] in 1932. It is widely employed by surgeons and anesthetists in Europe where it is known as evipan sodium. It is not a volatile anesthetic, but because of its rapid destruction in the body, the duration of action is short. Detoxication of evipal soluble is effected by its decomposition within the liver. Thus, in the rabbit, one-half the maximal narcotic dose is decomposed in thirteen minutes. Only traces of the injected substance are eliminated in the urine. In animal experiments, the animals fall asleep within a few seconds after intravenous injection of the drug. In addition to this remarkably rapid onset of narcosis, the duration of the effect is extraordinarily short because of the speedy decomposition. Birds awaken in thirty minutes, and mice in fifty minutes. By-effects on the circulation are absent or inconsiderable. The low toxicity is demonstrated by the excellent tolerance to very large doses in cats. Thus, from 20 to 25 mg. per kilogram body weight induces narcosis of only a few minutes' duration, but the same animals survive 100 mg. or even 110 mg. per kilogram doses of evipal soluble. This unusually low toxicity establishes evipal soluble as a true narcotic. From these data it is evident that the therapeutic index is greater than four. Storm,[2] in a series of 300 anesthesias in 100 monkeys, noticed no change in blood pressure or only a slight temporary fall. In rabbits the reduction of blood pressure is only 15 to 20 mm. while the pulse remains full and regular. When death of the animal was caused experimentally by deliberate overdosage, respiratory failure first occurred and was followed later by cessation of cardiac action. This order of attack on the medullary centers by an anesthetic is the desirable one, since, as is well known, depressed respiration is easily stimulated to renewed activity. The metabolism, body temperature, alkali reserve and blood sugar level are not affected to any noticeable extent. Stimpfl,[3] in reviewing 11 cases in which death occurred during evipal soluble narcosis, concluded that the principal factor was overdosage, especially in the presence of sepsis and severe general organic disease. Reschke,[4] in describing 2 deaths, concluded that the anesthetic is dangerous when used in acute inflammatory conditions

*Read at a meeting of the Chicago Gynecological Society, May 8, 1936.

of the upper respiratory tract since a barbiturate given intravenously may cause laryngeal spasm, resulting in severe respiratory obstruction. Weber,[5] in discussing the use of evipal soluble in obstetrics and gynecology, estimates that the drug has been used about 800,000 times, of which 12,000 administrations have been in France. He claims that only 4 deaths can be fairly attributed to the drug. Without a doubt there have been over a million administrations up to the present.

DOSAGE AND METHOD OF USE

The prescribed dosage calculated for body weight is 6 c.c. of the 10 per cent solution per 100 pounds of body weight. Evipal is supplied in ampules of 0.5 gm. and 1 gm. of the sodium salt, known as evipal soluble. By the addition of 5 c.c. of sterile distilled water to the 0.5 gm. ampule or 10 c.c. to the 1 gm. ampule shortly before use, a 10 per cent solution is made; each cubic centimeter represents 0.1 gm. of the drug. This solution is aspirated into a sterile glass syringe and then slowly injected into one of the veins in the bend of the elbow. The intravenous injection of evipal soluble does not cause any changes in the vessel wall even if the fluid is retained at the area of injection.

In the past few months this method of determining dosage on body weight has been changed to the following procedure in which the dosage is based upon the response of the patient to the anesthetic agent. The patient is asked to count slowly but audibly. The prepared solution (10 per cent) is injected into the vein at the rate of 3 c.c. the first minute. When the count stops, which is usually before 50 is reached, the dosage administered is noted and an equal amount may be given. This will cause surgical anesthesia with complete relaxation. If the operative procedure is lengthy then additional small (1 or 2 c.c.) amounts may be given when the anesthesia begins to wear off. In our cases we have never used over 10 c.c. of the 10 per cent solution in a given case at one time.

As a basal anesthetic, 3 to 4 c.c. are administered to the patient in her room. This produces sufficient relaxation and narcosis so that she may be easily transported to the operating room and not experience the mental torture of this journey or the fear and discomfort associated with the application of an ether or ethylene mask. When a hypodermic of morphine with or without scopolamine is used, a smaller amount of evipal soluble is necessary but greater care is needed in determining the dose. For this reason we do not employ preliminary medication. Evipal soluble as a basal anesthetic decreased to a minimum the amount of ethylene or drop ether. Relaxation was more complete and the patient's postoperative course was made easier because of the improved mental attitude. Sleep comes on quietly and quickly, the patient often yawning as though falling into natural slumber. Twitching of the face muscles and slight generalized movements may occur for a few moments. Muscular relaxation

sets in very early; the jaw drops and, therefore, attention should be directed to keeping it forward or an airway should be inserted. Pain stimuli produced by beginning the operation before the patient is completely asleep necessitate more anesthetic and cause greater difficulty in procuring complete relaxation. Respiratory stimulants and oxygen and 7 per cent CO_2 are always kept at hand but never had to be used in any of our cases.

POSTANESTHETIC COURSE

The duration of anesthesia varies with the dose and physical condition of the patient. The average dose will allow twenty to thirty minutes for operative work. The patient then yawns, stretches, and again sleeps for various periods up to one hour. During this period of recovery, however, she may easily be aroused. If questioned during this time, the answers are often disconnected, resembling those given by one under the influence of alcohol. There is no recollection of what transpired. Mild headache was experienced only occasionally and never persisted. Nausea occurs somewhat more often and is probably due to gagging because of a relaxed tongue or aspirated mucus. Excitement may occur especially if great pain is present, but it can be controlled by suitable doses of morphine. There have been no after-effects in any of our cases.

CLINICAL EFFECTS

The pulse and respiration rates and blood pressure were taken at definite intervals in 20 cases. The average pulse rate increase was 10 while the blood pressure decreased 10 mm. Hg pressure. Respirations after the first minute were slightly slower, averaging from eighteen to twenty a minute. If the patient was overly excited before going to sleep, the pulse and blood pressure were slightly increased as during the excitement stage in inhalation anesthesia. In 2 of our cases the patients were mild diabetics, having preoperative blood sugars above 150 as determined by the Benedict method. No increase in the sugar resulted during anesthesia. Four cases had slight albuminuria before the administration of the evipal soluble, but no increase was noted and there were no microscopic or secretory changes indicating any renal irritation.

The ages of our patients varied from twenty-three to sixty-nine, the majority being over forty. Many with carcinoma were cachectic and anemic. However, in these no ill effects or increased susceptibility to the drug were noted. Severe debility, with heart, liver or kidney disease is, of course, a contraindication to its use.

In the 4 laparotomies performed under evipal soluble no preliminary medication or supplemental anesthetic was used. The operation was begun as soon as the patient was completely relaxed; the prelimi-

nary preparation and draping having been done before beginning the injection. Relaxation was complete, straining entirely absent so that the work could be done easily and swiftly. Postoperative distention was slight and discomfort nil. Nausea occurred once in one case immediately upon awakening.

Several patients receiving radium in divided doses were given the anesthetic three times at intervals of five days. One patient has had the drug seven times over a period of six months. Repeated usage in a patient does not require an increase in the dose or change its effects. However, when given again to the same patient the dosage should depend upon the patient's reactivity and may not necessarily be the same as administered at first since her susceptibility may have changed in the interim. Patients have never protested to its repeated use.

Weber,[5] Stacey,[6] Fregyesi[7] and others have reported the successful use of evipal soluble in obstetrics and gynecology, the latter author having successfully employed evipal soluble with local infiltration anesthesia in 40 abdominal and 16 vaginal operations, which were too prolonged for evipal soluble anesthesia alone. He states that the combination worked ideally in his cases.

CASE REPORTS

Dilatation and curettage and radium	42 cases	Incision of perirectal abscess	1 case
Removal of cyst of breast	4 cases	Biopsy	7 cases
Implantation of radium	10 cases	Proctoscopic examination	5 cases
Cautery of carcinoma of cervix	1 case	Interposition operation	1 case
Appendectomy and uterine suspension	2 cases	Cautery of cervix	3 cases
Appendectomy	2 cases	Removal of papilloma of labia	1 case
Cystoscopic examination	5 cases	Resection of inguinal glands	3 cases
Dilatation and curettage	6 cases	Removal of Bartholin's cyst	1 case
		Basal anesthetic	3 cases
		Subarachnoid alcohol injection	3 cases

CONCLUSIONS

In our hands, evipal soluble has proved a very successful and satisfactory anesthetic for short operative procedures. In the 100 cases reported there have been no harmful effects from its administration. Its effects on respirations, heart action, blood pressure, and blood sugar level have been studied and no marked alterations were noted. In instances where three to five injections have been employed in the same individual, there has been no difference in the patient's response or the effect upon the functions of the body. Evipal soluble is deemed an ideal and safe anesthetic for brief anesthesia.

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OVARIAN PREGNANCY*

MORTIMER N. HYAMS, M.D., F.A.C.S., NEW YORK, N. Y.

(From the Department of Gynecology, New York Post-Graduate Medical School and Hospital, Columbia University)

BECAUSE of its comparative rarity, ovarian pregnancy is of great interest. The possibility of its occurrence was not recognized until the seventeenth century, and although cases reported subsequently were apparently authentic, this eventuality was questioned for a long time. Even today, there is considerable controversy and no two authors agree as to what constitutes a true primary ovarian pregnancy.

The case herewith reported is the first seen by me. A search of the records at the New York Post-Graduate Hospital reveals but three additional cases, one reported by Jacobson in 1908 and two unpublished cases. The first was under the care of West in 1924, and the second operated upon by Russell in 1922, and mentioned in this report with his permission. Of 187 patients operated upon for ectopic gestation from 1920 to 1935, but two proved to be ovarian pregnancies. Whether these two were true primary ovarian gestations cannot be determined at the present time, as the laboratory reports filed with the histories, based on present-day standards, are inadequate, and the specimens are not suitable for further study.

In 1917, Mayer and Wynne stated that, from the evidence contained in the literature, it is clear that further case reports of ovarian pregnancy are not needed for the purpose of establishing the occurrence of this condition, but such reports, nevertheless, may help in the determination of the relative frequency of this novel and sinister condition and also throw further light upon its genesis and the finer relations of the implantations.

Ovarian pregnancy has been described as primary or intrafollicular when the sperm cell enters through the aperture produced by the bursting of a follicle and impregnates the ovum which has not escaped, the opening closing and gestation proceeding in the sealed sac; secondary or superficial, when fertilization of the ovum takes place after its liberation from the graafian follicle with subsequent development upon the surface of the ovary.

For the determination of the primary type, the criteria of Spiegelberg, promulgated by him in 1878, were accepted as adequate up to the present century.

*Read before the Section of Obstetrics and Gynecology, New York Academy of Medicine, March 24, 1936.

He demanded that (1) the tube on the affected side be intact and have no organic connection with the gestation sac; (2) the fetal sac must occupy the position of the ovary; (3) it must be connected with the uterus by the ovarian ligament; (4) definite ovarian tissue must be found in the sac wall. In more recent years, Williams supplemented these by claiming that ovarian tissue must be present in several portions of the sac wall. Norris added that the tube on the affected side must not only be intact, but microscopically free from any evidence of gestation. Mapes and others differed from their confreres in that they accepted these concepts with reservations. These exacting requirements had for their object the definite distinction between the true and the doubtful. However, in the final analysis, each individual case must be viewed not only on the basis of the history and operative findings, but also of a careful gross and histopathologic study of serial sections taken from various parts of the specimen.

Because of the foregoing, I feel justified in reporting a case of true ovarian pregnancy.

Case Report.—On Sept. 6, 1935, Mrs. H. S., aged twenty-two years, presented herself complaining of amenorrhea and pain in the midportion of the abdomen. On September 2, she had sudden dizziness, fainting, nausea and vomiting with severe pains in the mid-abdomen above the umbilicus. Her physician, who had treated her for two years for gastric distress, attributed the immediate symptoms to a gastric upset. The menstrual history was negative, her last period occurring on July 28, 1935. She had been married one year, had never been pregnant, used postcoital douches as a contraceptive measure. On physical examination, she showed marked pallor; the abdomen was distended and there was tenderness in both lower quadrants. No masses were palpable. The cervix was slightly softened at the tip, deep in the culdesac, but not tender on manipulation. It showed no discoloration. The uterus was slightly enlarged, somewhat softened, not globular. It was in anterior position, freely movable and not tender. The adnexa could not be palpated. A blood count showed 2,450,000 red blood cells; 7,400 white blood cells and normal differential count; hemoglobin 57 per cent. The patient's appearance suggested bleeding, but she presented no positive evidence of it. As ectopic gestation was suspected, she was advised to enter the hospital. The Friedman modification of the Aschheim-Zondek test was strongly positive. The urine showed no evidence of blood; the stool, Benzidine 4-plus for occult blood, Guaiac test negative. On Sept. 10, 1935, a transfusion of 500 c.c. of whole blood was given which was followed by 3,530,000 red blood cells and hemoglobin 72 per cent. As her symptoms had subsided and repeated examinations revealed no evidence of masses in the pelvis, and her general condition improved, she was discharged from the hospital on Sept. 17, 1935, and instructed to keep under observation. She did not return until Sept. 26, 1935, for examination. On September 24, she noticed severe pain on defecation and this had become progressively worse and more constant. On examination, a very hard mass was found in the culdesac, the origin of which could not be determined. A diagnosis of ruptured ectopic gestation was made and the patient was readmitted to the hospital. On September 27, under gas-oxygen-ether anesthesia, the abdomen was opened through a suprapubic midline incision, starting from the symphysis to 1½ inches below the umbilicus. On opening the peritoneum, no free blood was found. A large mass, the size of an elongated orange, filled the culdesac of Douglas. The uterus was anterior to the mass, normal in contour, position, and color and showed no congestion; both fallopian tubes were in normal position and freely movable. The mass was identified as the right ovary, bluish red in color, hemorrhagic in type, and attached to the uteroovarian ligament, which was somewhat elongated (Fig. 1).

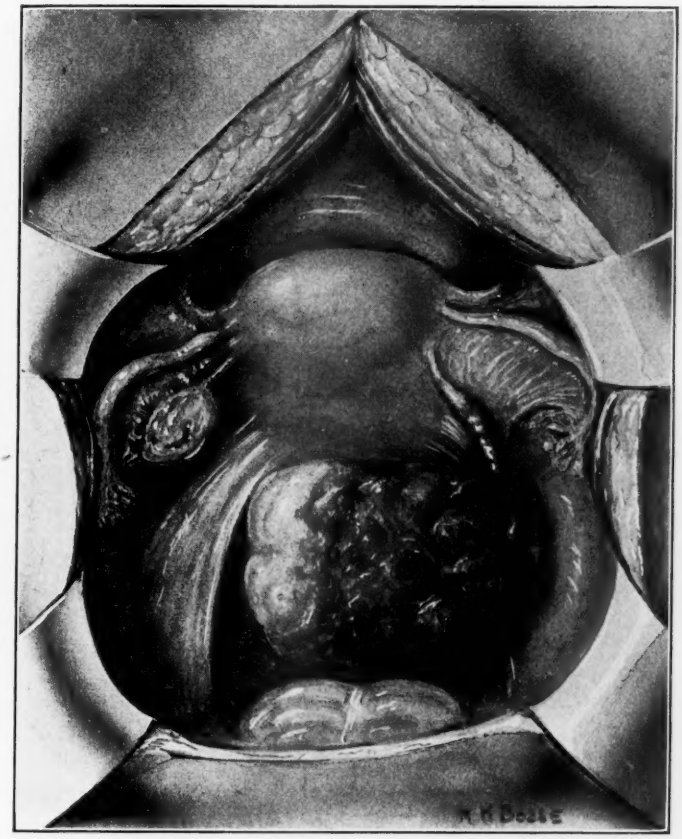

Fig. 1.—Appearance of ovarian pregnancy on opening abdomen.

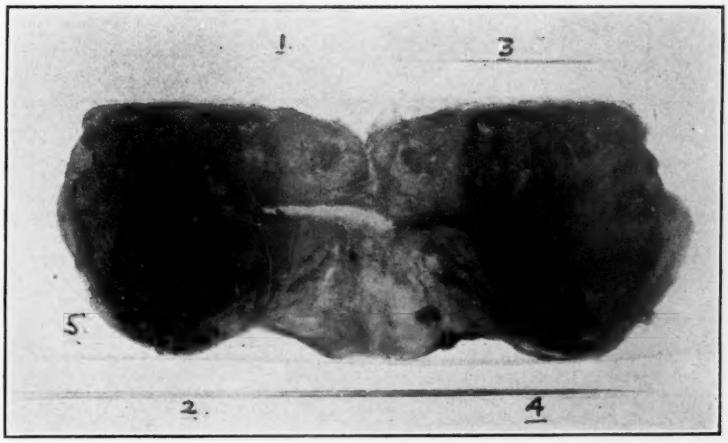

Fig. 2.—Gross specimen. Numbers indicate the five areas from which sections were removed for microscopic study.

The mass was excised and a prophylactic appendectomy performed. On September 30, three days after operation, a decidual cast was passed through the vagina. She made an uneventful recovery, leaving the hospital at the end of eleven days.

Fig. 3.—*A* and *B*. Microscopic Section 1, high power magnification. Shows hemorrhagic cyst to be partly embedded in ovarian substance (right). In the clot one is able to recognize typical fetal villi.

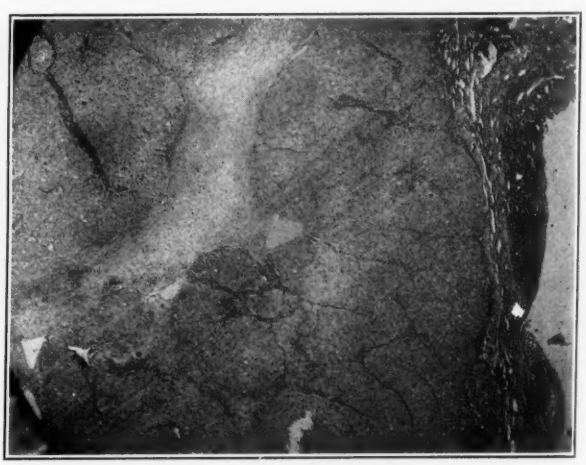

Fig. 4.—Section 2. High power magnification of the thickened portion of the ovarian cortex; shows many layers of large pale lutein cells about a largely centralized central blood clot (left); edematous ovarian cortex internal to the capsule of the corpus luteum with numerous large blood vessels.

The oviduct on the affected side at the time of operation was normal in color and appearance. There was no evidence of congestion or adhesions. The fimbriated end was pinkish in color and it was evident that no pre-existing blood clot had been

present. In the absence of any gross pathology, the tube was not removed. Considering the age of the patient, her social status and the possibility of future impregnation, it was felt that the removal of such a tube just for serial microscopic examination, to determine the existence of a possible pre-existing tuboovarian pregnancy, as advocated by Norris, would have been unfair to the patient.

Fig. 5.—Section 3, low power magnification, from opposite side of the hematoma including the capsule. Resembles Section 1. The capsule (left) is ovarian cortex; abundant blood channels and blood vessels suggest the trophoblastic area seen in the uterus in uterine pregnancy. Just internal to this layer the hematoma (right) contains fetal villi with central myxomatous areas and a covering of syncytial cells.

Fig. 6.—Section 4, high power magnification, from margin of hematoma directly opposite Section 3, Fig. 5. Viable portions which are composed almost entirely of large decidual cells.

PATHOLOGIC REPORT

Gross.—Specimen appeared to be an ovary with a large amount of clotted blood adherent to it. The specimen measured over all 50 by 50 by 45 mm. Apparently there was a portion of ovary or possibly entire ovary at one side. On section one recognized a corpus luteum 17 mm. in diameter. At one side of the specimen there

was a hemorrhagic cyst attaining a diameter of 58 mm. In the center of this, there was a cavity 10 mm. in diameter with some white opaque material in it and also portions of translucent membrane. One could not recognize an embryo with certainty, but apparently there was a portion of embryo present (Fig. 2).

Microscopic.—Sections as numerically indicated on the gross specimen (Fig. 2) were removed from five different areas.

Fig. 7.—Section 5, low power magnification, directly opposite Section 2, Fig. 4, including the capsule. Shows the partially organized hematoma (left). Throughout the hematoma there are numerous fetal villi, some of which show a basal attachment to chorionic sac (right).

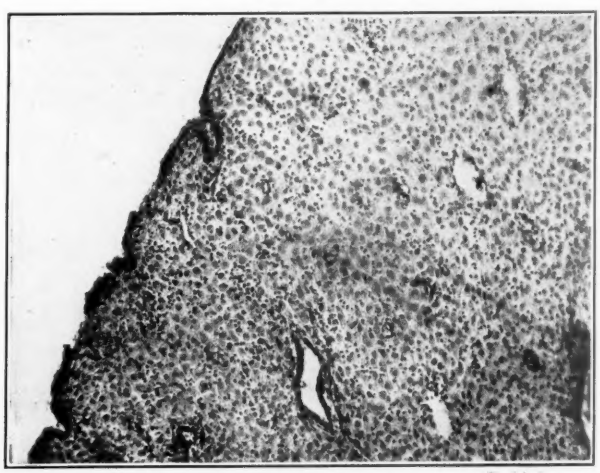

Fig. 8.—Decidual "cast," expelled from vagina three days following operation. Area showing complete replacement of endometrial stroma by decidual cells and sections of glands lined by columnar epithelium which also appears on the surface of the endometrium. There is moderate infiltration by polymorphonuclear neutrophiles and to a lesser degree by lymphocytes.

Section 1, high power magnification, showed hemorrhagic cyst to be partly embedded in ovarian substance. In the clot, one was able to recognize fetal villi (Fig. 3, *a* and *b*).

Section 2, high power magnification of thickened portion of the ovarian cortex, consisted entirely of many layers of large pale lutein cells about a central blood

clot which was largely organized. Internal to the capsule of the corpus luteum there was edematous ovarian cortex with numerous large blood vessels and portion of the wall of the tissue surrounding the central blood clot (Fig. 4).

Section 3, low power magnification, from opposite side of the hematoma including the capsule. Resembled Section 1. The capsule was ovarian cortex with marked increase of fibrous tissue and blood vessels. Abundant blood channels and blood vessels suggested the trophoblastic area seen in the uterus in uterine pregnancy. Just internal to this layer, the hematoma contained fetal villi with central myxomatous areas and a covering of syncytial cells (Fig. 5).

Section 4, high power magnification, from margin of hematoma directly opposite Section 3, Fig. 5. Viable portions which were composed almost entirely of large decidual cells (Fig. 6).

Section 5, low power magnification, directly opposite Section 2, Fig. 4, including the capsule. Showed the partially organized hematoma. Throughout the hematoma there were numerous fetal villi, some of which showed a basal attachment to chorionic sac (Fig. 7).

Decidual "casts," expelled from the vagina three days following operation. Decidual tissue showing purulent inflammation. Areas showed complete replacement of endometrial stroma by decidual cells and sections of glands lined by columnar epithelium which also appeared on the surface of the endometrium. There was moderate infiltration by polymorphonuclear neutrophiles and to a lesser degree by lymphocytes (Fig. 8).

Diagnosis.—Ovarian pregnancy.

In the present case a diagnosis other than ectopic pregnancy was not tenable from the clinical findings. Of particular interest is the short duration of pregnancy, and the fact that fourteen days before operation no adnexal enlargement could be detected.

78 East 79th Street

Larionov, V. F.: Influence of Placental Preparations on the Egg-Laying of Hens, Vopr. Endocrinol., Moskow, p. 824, 1936.

The author ran several series of experiments on feeding hens with human and animal placenta in the biologic laboratory of the Scientific Research Institute of poultry breeding. In nine different series of experiments 1,000 hens were used. Results show a definite increase of egg-laying ability. Twenty control hens from January to July 15 laid 848 eggs. The twenty experimental hens in the same period of time before experiment was started, laid 896 eggs. The experiment began July 16 and continued until September. The control hens laid 246 and the experimental hens, for the same period, 348 eggs. Other series showed similar increases under placental feeding. Size and incubation qualities of the eggs of the experimental hens were not altered. To exclude the conclusion that increased egg-laying depends on increased protein intake, control hens were fed the same amount of different proteins, as meat or dried blood in powdered form, but no beneficial effect could be noticed. The author thinks that stimulated ovarian activity is due only to the hormones contained in the placenta, and that continued experiments might show that fresh placenta contains vitamin E.

Alexander Gabrielianz.

IMPETIGO HERPETIFORMIS OCCURRING DURING PREGNANCY

BAYARD CARTER, M.D., AND RICHARD L. PEARSE, M.D., DURHAM, N. C.
(From the Department of Obstetrics and Gynecology, Duke University School of Medicine)

AS STATED by Highman,[14] "there are no skin diseases peculiar to pregnancy except certain hyperpigmentations, known as chloasmata." Any skin disease which occurs in pregnancy and which endangers the life of the patient or of the child, either directly or indirectly, should be of interest to the obstetrician.

In a series of 735 deliveries at Duke Hospital there were two patients with dermatitis herpetiformis, or impetigo herpetiformis, whose pregnancies, deliveries, and postpartum courses were markedly influenced by the disease. According to Irving, no patients with dermatitis herpetiformis, or impetigo herpetiformis, have been admitted to the Boston Lying-In Hospital during the past twenty years. Two case reports by Gellhorn and one by Howard have recently appeared in American literature.

Our first patient was a twenty-five-year-old white, single primipara at term, who was referred to the hospital in labor on Dec. 15, 1933, with a diagnosis of generally contracted pelvis. Uterine contractions had started three days prior to admission, were intermittent for two days, and were hard and regular for the twenty-four hours prior to admission. During the last trimester of her pregnancy she had noted a polymorphous rash which had appeared on her thighs, vulva, and trunk. The lesions were first erythematous macules which became vesicular, with turbid contents, and ruptured. The patient experienced considerable itching. A dermatologist made the diagnosis of dermatitis herpetiformis.

On admission her temperature was 37.6° C., pulse 100, respirations 24, and blood pressure 152/84. She was a well-developed and nourished young white female. There was no peripheral edema. The skin of the abdomen, vulva, and thighs was covered with crusted polymorphous lesions. The most prominent lesions were red macules varying in size from a few millimeters to a centimeter in diameter. The mucous membranes were not involved. The heart and lungs were normal. The fundus rose 30.0 cm. above the symphysis; the fetus was in L.O.A. position. There was no engagement of the head. The fetal heart rate was 132 per minute. Rectal examination showed the cervix to be effaced and three fingers dilated and the vertex not engaged. The membranes had ruptured. Pelvic measurements were: interspinous 21.0; intercristal 25.0; bitrochanteric 30.0; bituberous 9.0; posterior sagittal 9.0; diagonal conjugate 10.0; and external conjugate 16.0.

Her Wassermann reaction was negative. A catheterized specimen of urine was negative. The hemoglobin was 90 per cent (Sahli), red cell count was 5,000,000, and white cell count was 30,000. A differential count showed 87 per cent polymorphonuclears, 10 per cent lymphocytes and 3 per cent monocytes. There was no eosinophilia.

Because of the failure of the fetal head to engage after an adequate modified trial of labor, a cesarean section was performed under gas, oxygen and ether anesthesia on the day of entry. The incision was made through that part of the abdominal wall which contained few lesions and the more involved portions were blocked off with sterile gauze covered with collodion. A healthy female infant, weight 2,760 gm., length 48.0 cm., with no skin lesions, was delivered. The placenta and cord showed no abnormalities.

The patient's postoperative course was febrile. Her pulse and temperature rose steadily until they reached 140 and 40.8° C., respectively, on the third postoperative day when she had two severe chills. Her abdomen was distended, tender, and silent. Her white count on the fourth day was 12,000. She became irrational and very restless. A diagnosis of peritonitis was made. The patient was Ochsnerized and was given a transfusion of 450 c.c. of citrated blood. Under this treatment she improved and her temperature and pulse became lower. A blood culture taken on the third postoperative day was reported negative. Fluids by mouth were started and she was given multiple small transfusions of citrated blood. Her temperature began to show a marked daily elevation and signs of wound sepsis became evident without definite localization. On the twentieth postoperative day about 400 c.c. of foul pus were evacuated from the deeper structures of the abdominal incision. From then on her improvement was rapid and she was discharged on the thirtieth postoperative day. At the time of discharge the skin lesions were markedly improved. The skin showed numerous small areas of brownish pigmentation where healing had occurred. A few crusted polymorphous lesions were present over the abdomen, thighs, and vulva.

The abdominal incision had healed well with the exception of a granulating area at the site of drainage. The uterus was slightly subinvoluted, and there were tenderness and induration in the vaults. At no time during her course were there any mucous membrane involvement, diarrhea, or symptoms of latent tetany. No eosinophilia was ever demonstrated and repeated specimens of urine were negative.

The patient returned seven weeks after discharge from the hospital. The abdominal incision showed complete healing. The only evidence of skin involvement was the presence of a few brownish pigmented areas over the thighs and vulva. She had noted no fresh lesions of the skin and was in general excellent condition. The child had shown at no time any skin lesion and was also in excellent condition.

Because of the interest stimulated by the first patient, a much more satisfactory study was made of the second. She was a twenty-seven-year-old white married female who entered the hospital on July 7, 1935. She was due July 18. She complained of an itching rash of ten days' duration. It had first appeared as blisters on both sides of her nose and between her toes. Her chest, abdomen, thighs, vulval region, and shins soon were involved. She had tried to relieve the itching by breaking the vesicles by scratching or with a needle. As the rash became more generalized, marked ankle edema appeared. She had no symptoms of preeclamptic toxemia. Her habits were entirely unchanged and she denied the use of any drugs. She had no cramps, paresthesias, tetany or diarrhea. She had been treated prior to entry with some effervescent saline purgative.

The family history was irrelevant and there had been no nerve or skin diseases in her immediate family. She had had chickenpox, measles, and pertussis in childhood. She had never suffered from asthma, hay fever, urticaria, or other allergic manifestations. Menarche was at thirteen years. Her catamenia were normal and regular. She was supposed to have had a spontaneous abortion when a month pregnant in 1934. This abortion was not accompanied by any skin lesions.

On admission her temperature was 37.0° C., pulse 100, and respirations 17. The blood pressure was 136/76. She was a well-developed and well-nourished, young female in no obvious discomfort. Her hair was dry, brittle, and sparse, and she

stated that since the onset of the rash her hair had been "dropping out." There was a firm nodule about a centimeter in diameter apparently attached to the skull posterior to the right mastoid region. There were sparsely scattered crusted lesions 0.5 to 1.0 cm. in diameter on her scalp. On either side of her nose and in the nasolabial folds were small white scars, 2.0 to 5.0 mm. in diameter. The chest and both shins were thickly covered with vesicles, bullae, and crusts. The back, buttocks, thighs, lower abdomen, vulva and arms were covered with brown and red macules, and a few vesicles arranged in somewhat symmetrical patches with scalloped, circinate borders. The posterior auricular, cervical, axillary and inguinal nodes were all enlarged and palpable. The thyroid was not enlarged. The eyes, ears, nose, throat, teeth, and tongue were normal. There were no lesions on any of the mucous membranes. Liver and spleen were not palpable. The fundus extended 31.0 cm. above the symphysis. The fetus was in R.O.P. position, and the fetal heart was regular. The pelvis was quite adequate. There was a lesion that simulated an incipient paronychia on the middle finger of the right hand. There was marked pitting edema of both ankles, and the skin between the toes was moist and macerated. Neurologic examination was negative. There were no disturbances of sensation and no signs of latent tetany.

The Wassermann reaction was negative. The hemoglobin was 69 per cent (Sahli), the red count was 3,600,000, and the white count was 10,000. There were no bromides in the blood serum. Blood sugar was 70 mg. per cent and nonprotein nitrogen 22 mg. per cent. A catheter specimen of urine was negative.

The patient was seen by a dermatologist who made the diagnosis of dermatitis herpetiformis. The patient was kept in bed with a lighted cradle over her legs, and calomine lotion was liberally applied. There was little change in her condition and she required codeine. One per cent menthol in cold cream was applied with no relief. On July 12 the patient spontaneously went into labor. After nine hours and ten minutes, the cervix was fully dilated, and the head was 2 cm. below the spines. The fetal heart failed completely and forceps were applied. A right mesiolateral episiotomy was done, and a male infant, weight 3,130 gm. and length 50 cm., was delivered. The child showed marked livid asphyxia. By means of tubs and carbon dioxide and oxygen inhalations the infant was resuscitated. Ten cubic centimeters of maternal blood were injected into his right buttock. At no time up to the present has the infant had any skin lesions. He has gained and been vigorous and normal in every way.

About twenty-four hours following delivery the skin lesions became much worse and an evening rise of temperature to 38° C. was noted. Fresh lesions appeared around her mouth, below her nostrils, and on her eyelids. The lesions on her trunk, thighs, and vulva coalesced and became very active. Great quantities of serum exuded from the broken vesicles and bullae that appeared in almost hourly crops. Macules that itched intensely first appeared and were rapidly replaced by blebs and vesicles. The itching was so intolerable that the patient would scratch herself in her sleep. The lesion of the nail bed on the right hand developed into a typical lesion which persisted throughout her stay and caused the nail to be distorted. Her white count rose to 16,000. Her urine was negative. Blood calcium was 8.0 mg. per cent, but there were no signs of latent tetany. Plasma proteins were 4.9 gm. (albumin 2.7, globulin 2.2) per cent.

Because of the similarity between the patient's condition and that of one suffering from a burn of a large area of the body surface, she was placed on sterile sheets under a lighted cradle, and 1 per cent aqueous gentian violet was applied periodically to her skin. All cultures of the lesions were negative. The gentian violet formed thick crusts which prevented the loss of much serum and relieved the itching in some degree. She was given three transfusions of from 350 to 500 c.c. of citrated blood. Wherever she was venesected, or a needle inserted in the skin,

a typical lesion appeared. Because of the supposed rôle of parathyroid hypofunction, or dysfunction, in disorders of this sort she was given 20 c.c. of cod liver oil and 3 gm. of calcium gluconate daily. She also received other supportive treatment in the form of a high vitamin diet and iron and ammonium citrate. Her blood calcium continued low. On July 29 it was 7.9 mg. per cent, and the phosphorus was 4.5 mg. per cent.

At no time were there any signs of puerperal infection. The uterus involuted rapidly and well. Her general condition was unchanged, and she was very uncomfortable because of the itching. New crops of lesions appeared frequently on the sites of former lesions where the skin was slightly pigmented. Three intramuscular injections of from 15 to 20 c.c. of the serum of normally pregnant women were given without any effect. Her pulse rarely went below 100, and she had occasional

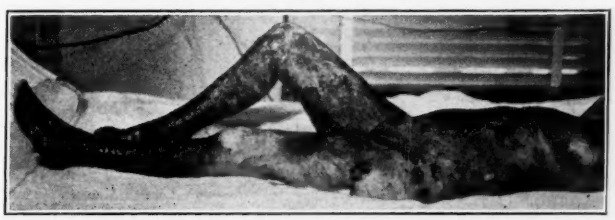

Fig. 1.—Appearance on Aug. 6, 1935, twenty-two days postpartum. The crusts formed by the gentian violet are very obvious.

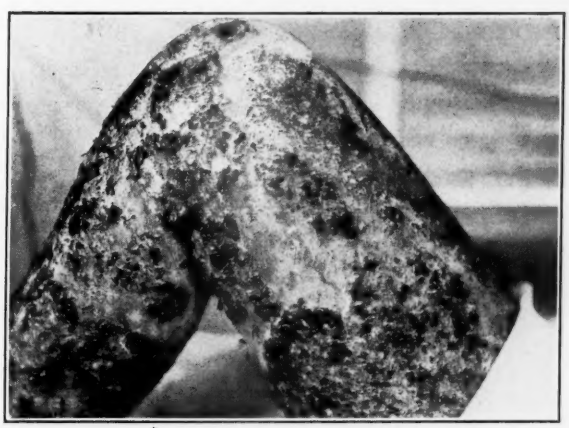

Fig. 2.—A closer view of the right leg showing the polymorphous lesion, pigmentation, and crusts.

daily rises of temperature to the level of 39.4° C. About a month postpartum her urine began to show a persistent trace of albumin with numerous red and white cells in the sediment. At the same time a persistent eosinophilia, which at times was as high as 37 per cent, became manifest. No eosinophiles, however, were discovered in the blebs or bullae.

During the week of August 14 to 21 she seemed to improve and the lesions showed a general tendency to regress leaving the skin pigmented in brownish patches with irregular borders. She had a mild and persistent diarrhea which was not well controlled by either paregoric or bismuth subnitrate. On August 23, edema appeared around her eyes and fresh bullae appeared around her lips and eyes. The next day she had a chill and her temperature rose to 40.2° C. All the fresh skin lesions rapidly regressed after the chill. Frank pus appeared in all the involved areas of her

face and there was so much local edema that she could barely talk or swallow. Cultures showed many colonies of beta streptococcus and *Hemolytic Staphylococcus aureus.* The patient was in the same precarious situation as one with a carbuncle of the upper lip or orbit. A special nurse kept continuous hot saline applications on the patient's face for four days. Fortunately, sinus thrombosis did not occur and the infection subsided on her face only to migrate and to appear under her breasts, in her axillae and on her shins and feet. She was given a series of six intramuscular injections of nonspecific foreign protein every other day. No local reactions appeared at the sites of injection. Liver extract in 2.0 c.c. doses was also given intramuscularly every other day from August 28 to December 15.

Following this period of acute infection there was a generalized regression of all infected lesions. Hot saline applications were continued wherever the purulent con-

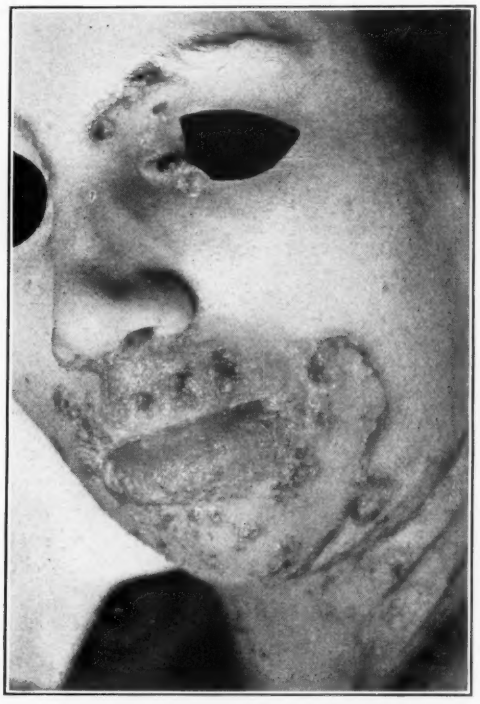

Fig. 3.—A fresh crop of vesicles, and the scaling, chronically infected lesion on the face at the time autogenous vaccine therapy was started.

dition of the lesions seemed to indicate them. Her trunk was soon free from active lesions, and only pigmented areas remained. On September 18 she had shown marked improvement and her trunk was entirely covered with sound epidermis. Gentian violet applications were discontinued. She was washed with green soap and kept on sterile sheets under lighted cradles. The patient no longer complained of the intense itching, and, considering the severity of her symptoms, her condition was remarkably good. The eosinophilia and albuminuria persisted. On only one occasion was indican demonstrated in her urine. No eosinophiles were found in the blebs or vesicles.

On September 20, for the first time, typical lesions appeared on the mucous membranes of the hard palate. These disappeared in twenty-four hours. Throughout the rest of her stay she had transitory crops of vesicles on her oral mucosa that caused little discomfort. From September 21 to October 5 she was given eight sub-

cutaneous injections of 100 c.c. of Ringer's solution in the sound skin of the buttocks. Each injection was followed by a generalized reaction, viz., chill and temperature elevation, but there was little local reaction. The fresh bullae and vesicles had a tendency to regress slightly after each reaction only in the uninfected areas.

Around her mouth, on her shins and the dorsa of her feet the lesions persisted apparently because they had become the sites of chronic infection. *Hemolytic Staphylococcus aureus* and beta streptococcus were again found on culture and stock vaccines were prepared. The condition seemed comparable to furunculosis. One-tenth of a cubic centimeter of each vaccine was injected intradermally. In twenty-

Fig. 4.—The residual pigmentation of the face following healing four months post-partum.

four hours the streptococcal vaccine had caused a wheal 2.5 cm. in diameter and the staphylococcal vaccine a wheal 1.5 cm. in diameter. About two days later typical polymorphous lesions developed at the sites of injection. Subcutaneous injections of the stock vaccines were made at four- or five-day intervals in doses increasing by 0.1 c.c. until 1 c.c. of each was given at a time. The site of each injection became the site of a typical lesion which went through all stages and was followed by the typical pigmentation of the skin.

On October 23, while still receiving the increasing doses of vaccine, the patient's left arm was given an exposure of 10 milliampere minutes of unfiltered x-ray. This caused a dramatic regression of all fresh lesions in about four hours. Up to January 27 she received 27 exposures to the various affected areas of from 4 to 12

milliampere minutes. After each exposure the regression of fresh lesions was remarkable. The patient would be encouraged and then lesions would appear elsewhere in the course of the subsequent twenty-four hours.

On November 14 she complained of a sore throat and of difficulty in talking. A laryngologist found ulcerations about 2 to 3 mm. in diameter on the epiglottis and left arytenoid. He suggested the possibility of a spirochetal or streptococcal infection, but it was felt that these were lesions similar to those on the oral mucosa. Shortly after this there was an exacerbation and new lesions appeared on her back involving the pigmented areas. Her temperature showed a marked daily rise, and she had a persistent tachycardia of 120 to 130. On November 24 she complained of a sore tongue and a typical lesion was discovered on it. Two days later the lesions on her tongue had disappeared without leaving a trace. Her rectum was examined by proctoscope for at least 18 cm. without difficulty, but no lesions were seen in rectal mucosa. Eosinophilia and albuminuria persisted.

From then on the improvement was gradual but steady. The lesions persisted especially around her mouth, in the left orbit, on both forearms, and on the dorsa of her feet. On January 15 ultraviolet treatment of lesions was started and was continued until February 3. The affected areas were exposed for two minutes at

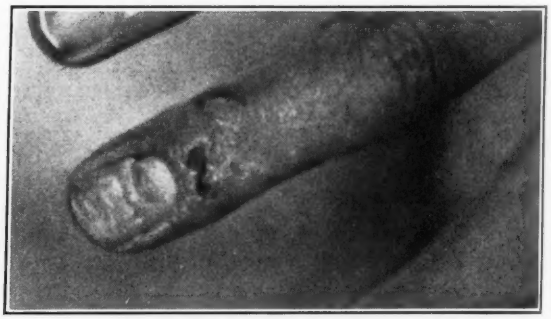

Fig. 5.—The lesion of the nail bed five months postpartum.

first and then for five minutes. By February 4 her face, trunk, and extremities were covered with sound skin pigmented a blotchy brown. The only areas which escaped pigmentation were the posterior surfaces of her thighs, buttocks, knees, elbows, palms, and soles. There was one small moist lesion barely a centimeter in diameter near her upper lip. She appeared in very good condition with little atrophy of her extremities after the long period of inactivity. Her temperature had been normal and her pulse 80 for fully a month. Her urine had become albumin free and the eosinophilia had dropped to 8 per cent. Blood calcium was 10.2 mg. per cent, phosphorus 5.7 mg. per cent, and plasma proteins 6.7 gm. per cent. (Albumin 3.7 gm. per cent, and globulin 3.0 gm. per cent.) A basal metabolic rate on discharge was minus 13 per cent. Plates of her skull and chest revealed no abnormality of the sella turcica or evidence of persistent enlargement of the thymus. Four days before discharge she commenced to have her first normal menstrual period since the time of delivery. At intervals of about twenty-eight days the patient had had a very slight bloody vaginal discharge for a few minutes the first two months after delivery. The other four months she had an absolute amenorrhea. Needless to say the baby was not allowed to nurse. The patient was discharged on the two hundred and sixth postpartum day. She returned for examination in six weeks. She had been taking viosterol and a high vitamin diet. The brown areas of pigmentation were blanching and presented a very mottled appearance. She had had

another perfectly normal period. There was a 1 per cent eosinophilia and her urine was negative. Blood calcium was 9.7 mg. per cent and phosphorus was 3.5 mg. per cent.

On May 19, 1936, the patient again returned for routine postpartum checking. She was in excellent condition. The hemoglobin was 90 per cent (Sahli), the red blood cell count was 4,550,000 and the white blood cell count was 5,400. No eosinophiles were found on examination of the smear and the differential count was normal. The catheterized urine specimen was negative. Her skin over the neck, trunk, abdomen, vulva, arms, and legs still showed marked brownish pigmentation, but the skin of the face showed no pigmentation. Her menstrual periods had been normal and she had had no gastrointestinal or neurologic symptoms. The child was normal in all ways and had showed no skin rash.

COMMENT

The foregoing patients undoubtedly fall into the group of cases classed as dermatitis herpetiformis, impetigo herpetiformis or pemphigus vulgaris or chronicus associated with pregnancy. Hebra[1] first described "herpes impetiginiformis" in 1872. The vesicular lesions appeared in the region of the thighs and genitalia and were accompanied by grave systemic manifestations. Four of the five cases reported by him terminated fatally. Duhring[2] described dermatitis herpetiformis in 1884 and according to his original article, none of his cases occurred in pregnant women and none was fatal. The manifestations were protean, viz., macules, papules, vesicles, and bullae appearing successively in crops. The course of the disease was long and its manifestations rebellious to treatment. According to Sutton,[15] in pemphigus the typical lesion is not polymorphous and the typical bullae appear on apparently sound skin. The mucous membranes are also more frequently involved. After reading a number of case reports and discussions, the distinctions between the three diseases appeared factitious to the authors. Some dermatologists are of the opinion that dermatitis herpetiformis and pemphigus vulgaris are identical, that lesions of the mucous membranes can occur in both and that no sharp distinction can be made between them clinically since the etiology is a mystery.[13] Others feel that the diseases may undergo transitions from one form to the other. Other observers feel that there are three entities: dermatitis herpetiformis, pemphigus and transitional forms. The criteria for distinguishing between dermatitis herpetiformis and impetigo herpetiformis seem to be the tendency of the lesions to localize in the region of the genitalia and the graver systemic manifestations present in the latter.[15] Modern authors report cases in men, children, nonpregnant women, and women past the menopause.[6, 7] All authors agree that these symptom complexes are likely to run a long course uninfluenced by therapeutic measures and that spontaneous remissions are very likely to occur. A patient with these diseases can never be considered cured.[15] There may be long periods of freedom from symptoms but exacerbations are notoriously likely to occur, especially with successive pregnancies in those patients in whom the original appearance was noted during pregnancy.

With the above convenient generalization it is possible to scrutinize the patients reported. The first patient had primarily involvement of the lower abdomen, thighs, and vulva with a polymorphous lesion, and, while under observation, no mucous membrane involvement. The second patient had a generalized rash of polymorphous character, intense itching, appearance of the rash in crops and was in excellent general condition despite the grave systemic manifestations. She also had involvement of mucous membranes, larynx, and nail bed. These symptoms have been reported in cases diagnosed both pemphigus, and dermatitis or impetigo herpetiformis, associated with pregnancy. The cultures of the lesions were at first sterile and the presence later of organisms was undoubtedly due to secondary infection. Eosinophiles have been reported in lesions of all three diseases, but none demonstrated in either patient. The second patient had diarrhea and Friedmann[8] reported a case in which the skin manifestations associated with successive pregnancies were preceded by an attack of diarrhea. The patient also had prolonged amenorrhea postpartum in view of the fact that she was not allowed to lactate. Werther and Leszczynski[5, 6] reported amenorrhea occurring with pemphigus associated with successive pregnancies for as long as two years. The persistent eosinophilia and the finding of red cells and albumin in the urine have been consistently reported by others. Other manifestations mentioned, which were not prominent in our patients, were loss of hair and involvement of the conjunctivae.

In neither patient were there any lesions on the children and in the second none appeared after injection of maternal blood intramuscularly. Blumenthal[3] reported lesions on an infant similar to those of the mother in a patient diagnosed impetigo herpetiformis. The child was born a month prematurely and the lesions cleared spontaneously in fourteen days. The infant died later of intercurrent infection. The mother had received arsenic but none could be demonstrated in the infant's urine or meconium. Werther[5] reported the case of a woman with pemphigus chronicus who had recurrent dermatoses with each pregnancy and who gave birth to a child covered with lesions which simulated the mother's but which disappeared in two weeks. This patient gave birth to a perfectly healthy infant in her next pregnancy. He also observed a thirty-seven-year-old woman with four previous normal pregnancies who developed pemphigus with her fifth pregnancy and gave birth to an infant covered with blisters filled with eosinophiles that disappeared in fourteen days. The mother died of an intercurrent staphylococcal infection, but the infant apparently flourished.

A most interesting finding in the second patient is the rather low blood calcium on entry. Modern German literature is replete with cases of hypoparathyroid tetany associated with impetigo herpetiformis.[6-8] Unfortunately in most of the reports no figures are given for the blood calcium levels. Although our second patient had no signs of latent

tetany, 8.0 mg. was a low calcium level. Tetany is usually manifest at levels below 7.0 mg. per cent. Bohnstedt[11] has reported a case of impetigo herpetiformis associated with pregnancy and overt tetany in a woman who had had a thyroidectomy. Danisch[7] has reported a fatal case of impetigo herpetiformis. The patient had had a subtotal thyroidectomy and the remaining apparently undisturbed parathyroids showed complete degeneration. Leszczynski[6] has reported 4 cases of tetany and impetigo herpetiformis, three associated with pregnancy and one with prolonged amenorrhea. Schardorn[8] first suggested an hormonic causal factor, dysfunction of the parathyroids. Most cases of impetigo herpetiformis are supposed to have occurred in the spring when most cases of tetany, or tetany associated with pregnancy, have been reported. Friedmann[8] suggested the possibility of a toxin of pregnancy depressing the function of the parathyroids. Bohnstedt[11] felt that the pregnancy was incidental because of the usual exacerbation of symptoms postpartum. The prematurely delivered fetus in his case had defective calcification of the bones. Danisch[7] and Leszczynski[6] suggest the theory that impetigo herpetiformis is due to a dysfunction of the sympathetic nervous system secondary to a disturbance in available ionized calcium. Cataract, changes in the hair and nails and night blindness all are known to occur with tetany and impetigo herpetiformis. Klopstock[4] in writing of pemphigus vulgaris associated with pregnancy attributes the blister formation to the changes in permeability brought about by the disturbance of the equilibrium of ions of the serum through some detrimental influence on the sympathetic nervous system. The blood calcium, apparently one determination, in the case reported was 9.4 mg. per cent; the blood was taken after delivery. Osteomalacia has been reported as occurring with impetigo herpetiformis.[5] Persistent thymus and changes of the hypophysis have accompanied the disease. Because of the similar embryologic origin of the parathyroids and thymus, it has been attractive to associate them in an explanation of the etiology. There was no evidence of enlargement of the thymus or pituitary in the case reported.

Hebra[1] considered the disease due to a fetal toxin. Howard[10] suggested damage to the vasomotor nerves by toxins or ferments from the chorionic epithelium. The placentas are supposed to show infarcts but in both of our patients no abnormalities were noted. Gellhorn[9] also assumed the cause to be some toxin connected with the pregnant state. Schreiner[13] attempted to explain the manifestations as due to sensitivity to iodine, and Werther as of allergic origin. Since the etiology of the symptom complex is so obscure, the means of treatment are very unsatisfactory. Most authors admit that treatment seems to influence the course of the disease very little and that prevention of secondary infection and supportive treatment are all that can be accomplished. Cases have been reported that dropped treatment and soon became symptom-free. Friedmann[8] admitted that healing would probably have occurred in his case

without any treatment. From the point of view of an obstetrician, it is important to know that these conditions are considered suitable indication for interrupting pregnancy and for avoiding pregnancy in the future, because of the notorious tendency to more severe exacerbations.[8, 11] The prognosis for the fetus, if the disease occurs early in pregnancy, is poor. Intrauterine death, abortion and miscarriage are frequently reported.[10] In later months premature labor commonly occurs.

Sedatives are necessary to control the itching. Any sort of local treatment that avoids secondary infection is indicated. Arsenic has been held in high favor at first in the form of Fowler's solution and later as sodium cacodylate, atoxyl or arsphenamine.[3, 12, 15] The rationale of the use of arsenic has apparently been that it "improves the complexion in sublethal doses." Potassium iodide has been tried and reported to cause exacerbations. Quinine, plasmochin, germanin and mercury have been used. Mayer in 1910 suggested the injections of the serum of normal pregnant women. Gellhorn[9] is about the only recent author to report favorable results. Horse serum and Ringer's solution have their advocates. Autogenous vaccines may be of some avail after the lesions have become secondarily infected. Our impression is that vaccination may have been of some value in controlling the infection but had no influence on the appearance of fresh lesions in the second patient reported. Because of the supposed hormonal origin of the symptom complex, all sorts of preparations from thyroid extracts to preparations of the ovaries, now known to be inactive, have been recommended. Jordan,[12] for example, recommends alternate treatment with arsenic and ovarian extracts. The administration of calcium to those with known low serum calcium would appear logical. Apparently the prolonged administration of calcium and cod liver oil raised the serum calcium from 8.0 mg. per cent to 10.0 mg. per cent but the course of the disease was not affected or mitigated. Most authors recommend the use of x-rays and certainly a transitory regression of lesions in a certain stage of development was obtained in our second patient. It must be kept in mind that when x-ray therapy was started a definite improvement had begun to occur in the second case reported and that the efficacy of that treatment cannot be accurately evaluated. Because of the possible rôle of the sympathetic system, irradiation of the spine has been suggested. Most authors agree that ultraviolet light may be somewhat helpful. In conclusion, to use the words of Duhring, it may be said that the symptom complex is very rebellious to treatment.

SUMMARY AND CONCLUSIONS

1. Two patients with dermatoses occurring during pregnancy are reported. Both occurred in primiparas near term and were characterized by polymorphous rash, itching, and the appearance of the rash in crops. In the first patient the lesions were primarily in the region of the geni-

talia, and in the second, their distribution was generalized. In the first patient, cesarean section was done because of failure of the head to engage after an adequate modified trial of labor. The postoperative course was complicated by peritonitis and wound sepsis. No special treatment was given for the skin lesions.

The second patient ran a course of 206 days following delivery. The loss of serum proteins due to involvement of large skin areas necessitated treatment as a burn. Secondary infection greatly complicated the course. Grave systemic manifestations were present together with eosinophilia, albuminuria, hematuria, diarrhea, amenorrhea, mucous membrane, and nail bed involvement. The serum calcium was low before delivery but tetany was never demonstrated. Calcium, cod liver oil, liver extract, the serum of pregnant women, Ringer's solution, nonspecific foreign protein, autogenous vaccine, x-rays, and ultraviolet light were all used in treatment. The disease probably ran a course uninfluenced by these measures and the most that can be said to have been accomplished was the prevention of loss of serum proteins and the control of secondary infection.

2. Impetigo herpetiformis, dermatitis herpetiformis, and pemphigus chronicus, or vulgaris, are, judging from a review of a number of case reports, similar symptom complexes. Similar manifestations are reported with all. Unfortunately, most case reports are deficient in studies of blood chemistry. The dermatoses recur with subsequent pregnancies. Amenorrhea is a frequent sequel.

3. The etiologic factors are not clear. Parathyroid dysfunction may play some part. Striking cases of impetigo herpetiformis associated with tetany have been reported.

4. Treatment probably influences the disease very little. Efforts should be directed toward maintaining the general condition of the patient and toward the prevention and control of secondary infection. In pregnancy the disease is an indication for termination and the prevention of future pregnancies. If the disease manifests itself early in pregnancy the outlook for the fetus is not good.

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A CONSIDERATION OF LUMBOSACRAL SPINA BIFIDA OCCULTA WITH SPECIAL REFERENCE TO UTERINE PROLAPSE*

GEORGE M. LAWS, B.S., M.D., PHILADELPHIA, PA.
(From the Gynecologic Service of the Presbyterian Hospital)

FOR several years I have been conscious of the fact that certain conditions encountered in the practice of gynecology are sometimes associated with occult spina bifida. Among them are bladder dysfunction, uterine prolapse in nulliparas, low back pain, anal sphincter weakness, and saddle anesthesia. An attempt to learn more about the rôle of the spinal deformity in bladder dysfunction and uterine prolapse has revealed widely different opinions about nearly every phase of spina bifida occulta but very few contributions dealing with genital prolapse. Therefore, a collective abstract of some of the literature together with certain personal observations are presented, with the thought that they are important enough to keep a pelvic surgeon more mindful of the posterior part of the pelvic girdle.

I. REVIEW OF LITERATURE

Historical.—The earliest recorded case is that of Athol, 1857, entitled "Fatty Tumor from the Sacrum of a Child Connected with the Spinal Membranes." Virchow was the first to use the term "spina bifida occulta," when in 1875 he reported the case of Miss Bell Carter of Blue Bank, Kentucky, who appeared in museums as "The Lady with a Horse's Mane" and proved to have the hidden spine defect in the upper dorsal vertebrae. Von Recklinghausen, 1886, in a classical paper described the pathology and gave the name "membrana reuniens posterior" to the connective tissue membrane that fills out the patency between the rudimentary neural arches. Alfred Fuchs, 1909, drew attention to the clinical entity that he found with an open sacral canal in all gradations down to a pathologic form of the sacral hiatus and coined the term "myelodysplasie" for the symptom complex he described; weakness of the sphincters, especially nocturnal enuresis persisting after puberty; syndactylis musually involving the second and third toes; disturbance of sensation, chiefly temperature sensation in the feet and toes; anomalies of cutaneous and tendon reflexes in the abdomen and lower limbs; club feet, sometimes with peroneal weakness; trophic and vasomotor disturbances in the toes.

Fuchs is often quoted, sometimes incorrectly, and the term myelodysplasia was adopted by Spiller and others. Gould's medical dictionary gives occult spina bifida as the synonym of myelodysplasia. Since the term implies a cord defect that does not always exist, it may have retarded progress in surgical treatment of the lesion. Brickner, in 1918, found only 12 operations reported in the literature and added five of his own. H. O. Mertz, of Indiana, 1933, found in the literature 79 laminectomies for occult spina bifida performed because of nerve control disturbance of the lower urinary tract in which the reports warranted conclusions as to results.

*Read before the Obstetrical Society of Philadelphia, May 7, 1936.

Over half were successful and the majority of the remainder were ameliorating. There was one death. Mertz recorded six operations. These operative results show that a congenital cord lesion is not present as frequently as was formerly believed.

Definition.—Posterior spina bifida occulta may be defined as a developmental deformity in which there is a cleft in the laminae of one or more vertebrae but no external sac. It is a rudimentary form of spina bifida (merorrhachisis). The laminae may be absent, or gape, or pass each other without fusing. In minor degrees of the defect the laminae meet except for a thin wedge of cartilage or there is a bifid spinous process. It occurs most frequently in the lumbosacral region where the vast majority of spine anomalies are located. Bony closure of the posterior vertebral arches begins in the lumbar region and proceeds upward and downward. Ossification begins at birth or earlier and the spinous processes of the lumbar and first sacral vertebras are ossified by the third year, while ossification of the fourth sacral is delayed until the seventh year. The appearance of spina bifida occulta is a normal finding in young children and occurs in 91 per cent from one to two years of age (Hintze).

Incidence.—Theodora Wheeler studied a thousand consecutive x-ray plates of the lumbar region in white adults over eighteen years of age at Johns Hopkins Hospital. She found incomplete closure of the last lumbar arch in 2.3 per cent, the incidence in males and females being about the same. She found incomplete closure of the first sacral arch in 13 per cent, but said, "one must choose a rather arbitrary standard of what constitutes a defective first sacral arch, since transitions from a fully formed one to an incomplete one are gradual." She collected several large series from the literature and calculated the entire sacrum was open in 2.89 per cent. Willis studied 1,400 skeletons and noted a bifid neural arch in 1.2 per cent of the last lumbar vertebras. He regards bifid neural arch as a normal finding in the lower sacral segments and noted its great frequency in the first sacral. Schmorl and Junghanns, in their x-ray study of 10,000 spines, are in accord with writers who place the incidence of the anomaly at from 15 to 20 per cent. Those who report an incidence of 35 per cent must include cases in which the sacral hiatus reaches a higher level than they consider normal. Radlauer studied 500 sacra in various races and found that closure of the hiatus sacralis occurred, over the third arch and between the third and fourth in 27.4 per cent, over the fourth arch and between the fourth and fifth in 45.6 per cent, and over the fifth arch in 14 per cent.

This wide variation in opinions as to what x-ray findings are to be interpreted as occult spina bifida no doubt explains the contradictory views of those who think it is never important clinically and those who find it associated with symptoms in nearly every case. If we discard minor posterior fusion defects of the first sacral arch and all varieties of sacral hiatus, there will remain an incidence of at least 4 per cent in adult women that must be considered definite cases of occult spina bifida. I believe that, in addition to these, anomalies of the lower sacral segments deserve further study, since the sacral plexus is composed of nerves emerging through the second, third, and fourth sacral foramina and can readily be involved, not only at the lumbosacral junction but also low in the sacral canal.

Pathology.—When the cord is primarily involved the picture is akin to syringomyelia. At operation and autopsy the usual findings have been: (1) Closure of the cleft by a tough membrane adherent to the overlying skin or nonencapsulated fat and connective tissue; (2) a myofibrolipoma extending through the cleft and into the bony canal disturbing and compressing the cord and its roots; (3) perforation of the membrane by a dense band attached to the subcutaneous tissues externally and compressing the cord structures internally.

Since the spine grows faster than the cauda equina, symptoms due to stretching of the roots may not appear until adolescence or adult life. The myofibrolipoma, also called a teratoma, may grow at any time and cause pressure symptoms. Trauma may aggravate latent symptoms.

X-ray Diagnosis.—The x-ray diagnosis of spina bifida occulta has been found accurate as a rule. It has been noted, however, that calcification of the membrana reuniens posterior has led to faulty interpretation. There is a healed form of occult spina bifida, not demonstrable by x-ray, in which external signs and nerve changes are present. Operators have commented upon the discrepancy between the x-ray findings and the true pathologic condition in young children. The difficulty of establishing the diagnosis of a neurologic lesion in connection with the bony defect has led to the injection of lipiodol into the spinal canal. This procedure is not without its dangers and has not become as popular in this country as it is in France.

Clinical Signs and Symptoms.—Of the local signs hypertrichosis is the most striking, but occurs in only 4 per cent of cases. It is congenital but increases at puberty. Fovea sacralis, one or two sacral dimples, persisting after the twelfth year, signifies a developmental sacral defect. It was found by Cramer in 40 per cent of 200 infants. Scars, striae, naevi are occasionally found. A subcutaneous lipoma or hemangioma may be present. The local signs are usually absent and any of them can occur without occult spina bifida (Winkler, W.). The spinal cleft may be palpated if it is wide enough. Pressure over the cleft caused a desire to void in one of my patients.

The bifid neural arch weakens the spinal column by impairing ligamentous attachments and predisposes it to strains and sprains. The weakness may be dormant until put to test by severe stress or trauma. Dr. W. S. Newcomet x-rayed a large number of men in a military training camp who complained of disabling low back pain, and he found an astonishing incidence of ecult spina bifida. Halstead made the same observation in another camp.

Peripheral Symptoms.—The neurologic symptoms consist of motor, sensory, and trophic disturbances and may be absent or occur singly or in groups. They may be indistinguishable from symptoms produced by other lesions, and even if found coexisting with the spine defect there may be no causal relationship. Saddle back anesthesia may be present involving the buttock, perineum, and posterior half of the vulva. Other deformities may be present either as a result of the nerve lesion or independently. The commonest deformity, clubfoot, is ascribed to progressive paralysis and most often is of the clawfoot type (A. Steindler). It is estimated that spina bifida occulta is present in 60 per cent of persons with clubfoot. Flexion contracture of the knee and dislocation of the hip are reported (G. Pieri and R. S. Smith).

Visceral Symptoms.—(a) *Anorectal signs* include relaxed sphincter ani, sometimes with incontinence, sometimes with prolapse of the rectal mucosa; loss of anal reflex; loss of the normal retraction of the anal area when the levator ani muscles are paralyzed (Coughlin).

(b) *Urinary Signs and Symptoms:* Enuresis is almost universally regarded a prominent symptom. The theory is that the dysfunction is primarily irritative. Constant irritation affects the vesical center in the cord and so alters its action that during sleep when there is no psychic control the bladder automatically empties.

Peritz said that 68 per cent of adults with nocturnal enuresis have spina bifida oculta. On the other hand, West found it no more frequent in 81 adult bed wetters than in 100 controls. Without doubt, functional incontinence, not merely nocturnal, is the commonest urinary symptom. Next in frequency is partial retention with or without overflow. Acute retention is rare. Dilatation of the ureters and renal pelves without obstruction occurs in children probably as the result of defective innerva-

tion of the pelvic ureter (Mertz). In severe cases a "Cord" bladder has been found. Sometimes there is anesthesia of the urethra (Findlay).

(c) *Uterine Prolapse:* It has been stated that uterine prolapse in nulliparas, in the majority if not all cases, is due to the existence of an unrecognized occult spina bifida which involves the fourth sacral nerve with consequent paralysis of the levator ani muscles and shows a pronounced tendency to recurrence after operation (Sturmdorf). Ebeler x-rayed 28 parous women with uterovaginal prolapse and found 23 of them to have occult spina bifida as compared with 28 parous women without prolapse of whom three had this defect. He gave no details of these remarkable findings (Ebeler and Duncker). Palmer Findley in 1917 called attention to this observation and to the fact that prolapse in the newborn was nearly always associated with spina bifida vera. He concluded, with other writers, that defective innervation of both the muscular and connective tissues is a causative factor in congenital uterine prolapse.

II. PERSONAL OBSERVATIONS

In my follow-up clinic I found 3 multiparas with early recurrence after operation for procidentia. All three had definite spina bifida occulta. I then decided to repeat Ebeler's study and had x-rays made in 25 other parous women operated upon for uterovaginal prolapse. Only one of the 25 showed a definite spina bifida occulta. This patient was particularly traced because I remembered that she had the combination of procidentia and postoperative foot drop in a congenitally deformed limb which proved to be dislocation of the hip. She still has a good result nine years after vaginal hysterectomy. I have had two other patients with postoperative foot drop. Both followed vaginal operations for prolapse. X-ray was negative in one case, diagnosed hysteria; the other has not been traced. My findings were not striking like those of Ebeler, quoted above, but they are at least suggestive that occult spina bifida may be a more frequent cause of recurrence of prolapse in multiparas than is generally recognized. Consideration of foot drop calls attention to Spiller's warning that extreme flexion of the trunk on the thighs may overstretch the caudal roots and produce paralysis of the legs and bladder. Conversely, overflexion of the thighs in the lithotomy position may stretch these roots, especially if already put on stretch by adhesions to the sacral canal, as occurs in occult spina bifida.

For comparison with the 25 x-ray films, I looked up the films of 25 women recently examined for kidney lesions and again found only one with occult spina bifida of the same severe degree. This patient had a stricture of the pelvic ureter, similar to one formerly found in a young woman with the spine defect.

I have had x-rays taken in several women with unexplained bladder dysfunction, usually manifested by incomplete control or residual urine, and have found five of them to have definite spina bifida occulta. Two other bladder cases were reported by radiologists elsewhere to have occult spina bifida but the films were found to show an anomaly

limited to the sacral hiatus, and they are not included. I have previously reported a personal failure to cure incontinence by the Kelly operation in a nullipara with occult spina bifida.

COMMENT

There is ample evidence in the literature to show that occult spina bifida may cause motor and sensory disturbance in the sacral plexus.

Symptoms due to involvement of the sacral plexus should be the most common, since it is involved by fusion defects at the lower as well as the higher levels of the lumbosacral region.

The emphasis usually placed upon nocturnal enuresis, a rare complaint in gynecologic practice, may properly be directed to other symptoms of bladder dysfunction in women.

Weakness of the pelvic floor and relaxed sphincters are associated with occult spina bifida more often than is indicated by current gynecologic publications.

These symptoms may be latent or absent until adult life, and then be considered as entirely due to injuries of childbirth.

The vaginal plastic surgeon should think of occult spina bifida in terms of innervation of the skin, muscles, and connective tissues of the pelvic floor, not merely as it may be related to virginal uterine prolapse.

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DISCUSSION

DR. SAMUEL B. HADDEN.—This subject is one that has been recently receiving attention that will result in a more clear understanding of the problem of spina bifida oculta.

The common complaints of spina bifida oculta are mainly those of bladder dysfunction, plus a sense of disturbance in the sacral distribution. Those symptoms are very much the same as those of cord tumor. In reality, spina bifida occulta is

a product of spinal tumor in that the symptoms are the result of involvement of the fibers after they have left the cortex. At the present time, I feel the problem of what constitutes spina bifida occulta and the importance of x-ray findings is in very much the same situation as was the problem of head injury when we paid so much attention to the x-ray findings. I do not believe the x-ray findings in themselves are of particular importance.

The voluntary innervation of the pelvic muscles is of course from the lower sacral routes, but in addition they must receive definite sympathetic innervation. This sympathetic innervation comes off at a much higher level than would be involved in an ordinary spina bifida occulta, although lesions in the sacral levels could cause involvement of the parasympathetic systems.

Very recently some splendid work has been done by Dr. Lanworthy on the control of the bladder, and by his systematic studies, he has aided considerably in adding to the knowledge of spina bifida occulta.

In conclusion, I repeat that many of the symptoms of spina bifida occulta are nothing more than symptoms of a cord tumor. The problem is one which should receive more attention and lead to more cooperation between gynecologists and neurologists.

VASCULAR-RENAL EFFECTS OF POSTERIOR PITUITARY EXTRACTS IN PREGNANT WOMEN*

WILLIAM J. DIECKMANN, S.B., M.D., AND HERBERT L. MICHEL, S.B., M.D.,
CHICAGO, ILL.

(From the Department of Obstetrics and Gynecology of the University of Chicago and the Chicago Lying-In Hospital)

THE parenteral or intranasal administration of extracts of the posterior lobe of the pituitary gland produces a decrease in the volume of the urine, an increase in the concentration of the urinary chloride, and little or no rise in the blood pressure of nonpregnant individuals. The duration of these changes varies with the amount of extract administered, but the magnitude of the response seems to bear no relation to the size of the dose. Pituitrin given to certain patients with toxemia of pregnancy produced responses similar to those described above with but one exception, namely, a marked increase in the blood pressure. This susceptibility to pituitrin was noted with great constancy in typical preeclamptic and eclamptic patients; it, therefore, appeared to offer a means of differentiating these patients from the pregnant women with primary or secondary hypertension.

Kamm and his coworkers have been able to separate two fractions from the posterior lobe of the pituitary gland, pitressin and pitocin. Pitressin is composed of the pressor and antidiuretic components, while pitocin contains the oxytocic principle. Each preparation has a minute amount of the other.

Ward, Lyon and Bemis compared the action of pituitrin, pitressin, and pitocin on pregnant women. They stated that pitressin and pituitrin produced an increase in the systolic blood pressure of 17 and 10 mm., respectively, which lasted for fifteen

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minutes. Pitocin caused an increase of only 5 mm., returning to the normal in five minutes. They made no studies of the water balance and the observations on the blood pressure changes were inadequate.

Chipman and Dieckmann each have stated that the use of pituitrin in the induction of labor in preeclamptic patients has occasionally seemed to be the cause of the onset of convulsions. Eclampsia, of course, occurs most frequently during labor, and the irritating effects of the uterine contractions may have been the cause of the onset of the convulsions rather than the pressor and antidiuretic action of the pituitrin.

METHOD

Catheters were inserted into the bladders of normal and toxemic, pregnant, parturient, and puerperal women for the period of study. Water was given by mouth in amounts varying from 150 to 250 c.c. per hour. Urine specimens were collected every hour. After a satisfactory volume of urine had been obtained, one-half to two minims of pituitrin, or one of its fractions, were injected subcutaneously in the pregnant patients and intravenously in those in the puerperium. Blood pressure readings were taken before the injection until they were constant, and then every two minutes for a period of ten minutes following the injection. The blood pressure either returned quickly to normal or it remained increased for hours. Sixteen normal pregnant women, 12 patients with vascular-renal disease in pregnancy and 19 toxemic patients have been studied.

RESULTS

Normal Pregnancy.—The volume of urine excreted per hour was not diminished during labor. The injection of pituitrin or pitressin produced a marked decrease

TABLE I

SUBSTANCE INJECTED	NUMBER OF PATIENTS		VOLUME OF URINE PER HOUR				BLOOD PRESSURE INCREASE IN MM. OF HG
			HOURS BEFORE INJECTION		HOURS AFTER INJECTION		
			2	1	1	2	
A. Normal Pregnancy							
Pituitrin	15	Average	153	149	77	77	11
		Range	50-219	30-300	10-180	5-198	0 to 20
Pitressin	6	Average	165	169	127	113	4.8
		Range	110-195	114-210	65-165	62-170	0 to 8
Pitocin	5	Average	159	188	128	122	2.5
		Range	136-180	168-210	96-160	92-152	0 to 4
B. Vascular-Renal Disease in Pregnancy							
Pituitrin	12	Average	176	179	119	110	7.7
		Range	122-230	120-250	60-195	65-166	-10 to 18
Pitressin	6	Average	186	180	130	136	6.8
		Range	166-204	152-210	64-160	90-166	0 to 8
Pitocin	9	Average	196	192	129	145	6.8
		Range	154-224	152-218	82-172	44-180	-2 to 14
C. Preeclampsia							
Pituitrin	19	Average	150	135	49	60	51
		Range	17-305	18-300	0-100	0-300	28 to 80
Pitressin	4	Average	92	112	46	72	23
		Range	46-128	32-183	16-70	24-110	10 to 44
Pitocin	5	Average	149	142	53	75	20
		Range	96-210	82-198	32-112	15-192	12 to 28

in the volume of urine and slight to moderate elevations in the blood pressure. No significant differences were noted for the three substances, although pituitrin, as a rule, gave a more marked increase in the blood pressure. Injections of pitocin did not have as great effect on the urine volume and blood pressure as the other two substances. The average figures are given in Table IA. A typical case is illustrated in Fig. 1.

Vascular-Renal Disease in Pregnancy.—This group is composed of patients who are commonly designated by the obstetrician as having "chronic nephritis." Other terms used are "recurrent toxemia of pregnancy," "latent nephritis," "occult nephritis," etc. The important abnormal finding is a hypertension. Albuminuria frequently occurs near term. The renal function is usually at the lower limits of normal. Ophthalmoscopic examination is of value only if it shows abnormal changes. Usually the disease has been of relatively short duration and little, if any, pathology is present in the arterioles of the eyes or skeletal muscles and no cardiac hypertrophy

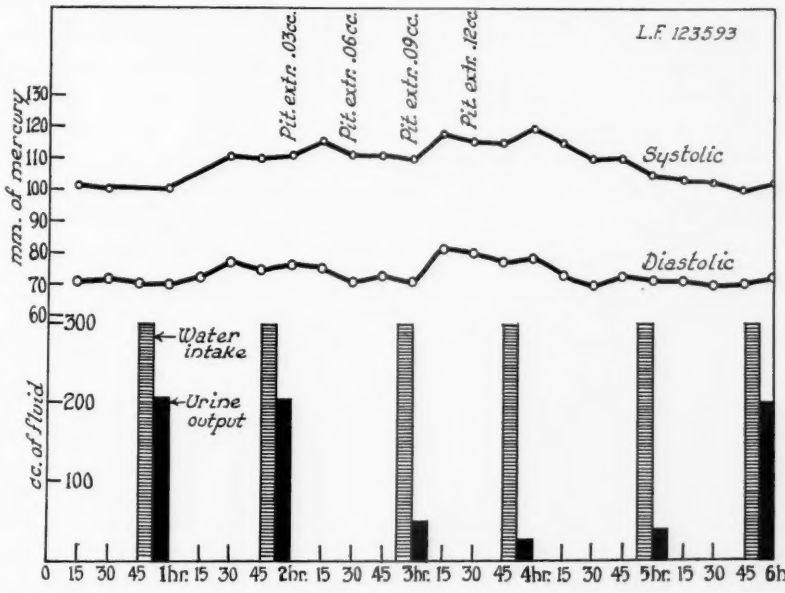

Fig. 1.—Normal pregnancy. Pituitrin causes marked oliguria but no increase in blood pressure.

is ordinarily demonstrable. The hypertension may have been present before pregnancy occurred or it may have been caused by the pregnancy. A small majority of pregnant women have renal impairment which is due either to a chronic glomerulonephritis, nephrosclerosis, or eclampsia. The responses obtained with the three substances are similar to those found in normal pregnancy. The average figures are listed in Table IB. A typical case is illustrated in Fig. 2.

Preeclampsia.—This condition is characterized by the appearance of edema, albuminuria, and hypertension in pregnant women who had not shown these signs previously. Various cerebral and visual symptoms, which may be the result of edema of the brain, gastrointestinal symptoms, and an oliguria or anuria usually occur just before the onset of convulsions and coma. Injection of pituitrin caused a very abrupt and marked increase in both the systolic and diastolic blood pressure and a marked decrease in the volume of urine. No significant difference was noted with the use of pitressin or pitocin, excepting that the increase in blood pressures was less marked.

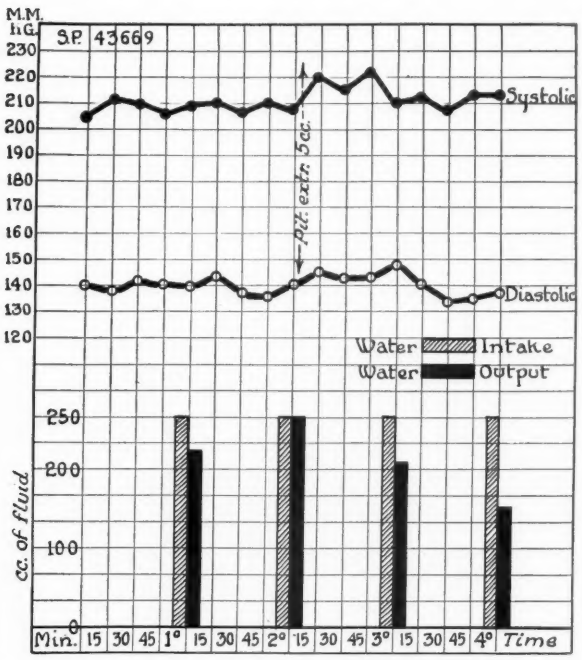

Fig. 2.—Vascular-renal disease (essential hypertension) in pregnancy. Pituitrin has no appreciable effect on blood pressure.

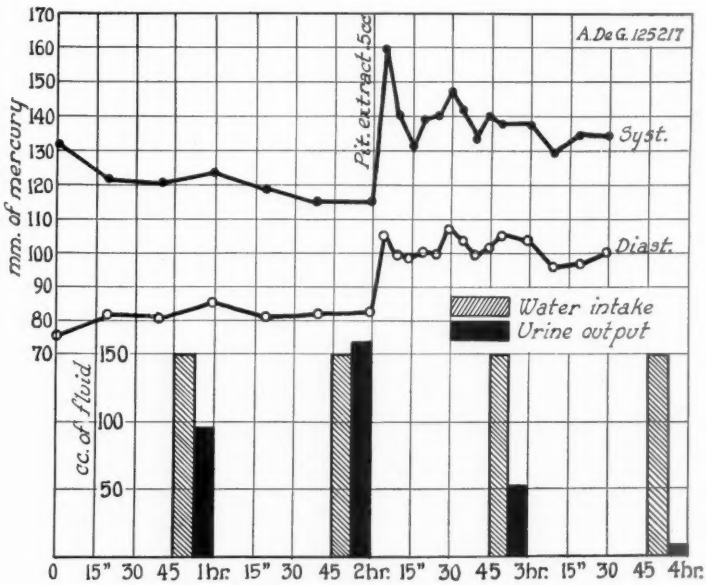

Fig. 3.—Preeclampsia. Pituitrin causes marked increase in both systolic and diastolic blood pressure and also an oliguria.

The oliguria became so marked in one patient following the injection of pituitrin that an acute pulmonary edema was produced. In another patient there was an abrupt and marked rise in the blood pressure, which may have been a factor in causing the partial abruptio placentae.

Average figures are listed in Table IC. A typical case is illustrated by Fig. 3.

The specimens of urine were analyzed for chloride and nonprotein nitrogen, and the specific gravities (gravimetric method) were also determined. The urine obtained after the injection of pituitrin or either of the fractions usually showed an increased concentration of chloride. There was little or no alteration of the nonprotein nitrogen concentration. Naturally, the specific gravity would be increased if the chloride concentration was increased. No correlation could be demonstrated between the degree of decrease in the volume of the urine and the increase in the chloride concentration.

DISCUSSION

Anselmino, Hoffman and Kennedy reported that they had demonstrated an excessive amount of the antidiuretic and pressor principles of the posterior pituitary gland in the blood of patients with toxic albuminuria of pregnancy or eclampsia. They stated "full agreement was established between the most important individual symptoms and experimentally reproducible actions of the autacoid; these included water retention through diuresis inhibition, rise in blood pressure, capillary spasm, coma and fits, lung edema, the lessening of galvanic irritability, certain ionic movements from blood to tissues, and the controlling effect obtained by certain definite narcotics and hypnotics. Quantitative estimations of the autacoid ran parallel to the severity of the symptoms. The hypothesis is advanced that toxic albuminuria of pregnancy and eclampsia are endocrine disturbances probably of a pluriglandular nature, but in which great overproduction of the hormones of the posterior pituitary dominates the picture."

Our work demonstrates that the preeclamptic patient reacts markedly to injections of the posterior pituitary gland, as evidenced by the oliguria, increase in blood pressure and occasional appearance of the characteristic cerebral and visual symptoms and signs. The increase in blood pressure is much greater in preeclampsia than it is in normal pregnancy or vascular-renal disease.

The fact that injections of pituitrin act as they do in preeclamptic patients indicates the possibility that the posterior lobe of the pituitary gland may in some way be associated with the disease. Too much secretion may be produced, there may be some defect in its neutralization, or the individual may be unduly susceptible to its action. The rapid amelioration and occasional disappearance of all symptoms and signs within a period of two or three days in both preeclampsia and eclampsia indicate that if there was any disturbance of the pituitary gland, it was a functional one and not an organic change in structure.

Our data would seem to lend strong support to Anselmino and Hoffman's work. However, Byrom and Wilson, Theobald, Page (assisted by Anselmino), and Hurwitz and Bullock, working independently, were

unable to demonstrate the pressor and antidiuretic substances in the blood obtained from preeclamptic and eclamptic patients. Thus the work of Anselmino and Hoffman remains unconfirmed. Their conclusions were apparently based on too few controls and an insufficient number of experiments.

The results obtained in this study have a double implication: (1) The injection of pituitrin per se may be dangerous in toxemic patients even in small amounts. There is some indication that pitocin is more desirable where the injection of a pituitary extract is indicated; (2) pituitary extract in minute doses offers a good test in differentiating preeclampsia from vascular-renal disease in pregnancy.

In a previous paper the authors emphasized the value of the cold pressor test in pregnancy. In that study 190 patients (300 to date) were observed. Patients with vascular-renal disease in pregnancy gave marked pressor responses with ice water stimulation, whereas the preeclamptic patients gave only moderate and variable pressor responses.

Thus, we have a double check for differentiating the two types of conditions in pregnancy, namely, the administration of small doses of pituitrin to indicate which patients are preeclamptic, and the cold pressor test to indicate which patients belong to the vascular-renal group.

The fact that an injection of pituitrin may produce an oliguria, rise in blood pressure, and other symptoms makes its administration undesirable in preeclamptic patients. The use of ergonovine after delivery would seem preferable. Adair, Davis and coworkers stated, "We reached the tentative conclusion that the administration of ergotocin (ergonovine) in therapeutic doses has little or no effect on the blood pressure curve of patients with or without hypertension. We also believe that there is no effect on urinary output."

CONCLUSIONS

1. The volume of urine is not diminished during labor in normal pregnant women if the fluid intake is adequate.

2. It is, however, decreased during labor in preeclampsia or eclampsia, and the forcing of fluids may produce undesirable and occasionally dangerous symptoms and signs.

3. The parenteral injection of extracts of the posterior lobe of the pituitary gland produced the following changes:

a. A decrease in the volume of urine, an increase in the chloride concentration, and an average rise in the systolic blood pressure of 11 mm. Hg in normal pregnant, parturient, and puerperal women. Similar changes occurred in the vascular-renal group.

b. A markedly decreased volume of urine, an increase in the chloride concentration, and an average rise in the systolic blood pressure of 51 mm. Hg in preeclamptic patients.

4. The cold pressor test is emphasized as a method to differentiate the vascular-renal group from the preeclamptic group.

5. The dangers of pituitrin in the preeclamptic group are made apparent, but its value as a test is emphasized.

6. Pitocin does not produce as marked an increase in blood pressure as pituitrin, hence, pitocin is preferable to pituitrin for the induction of labor in toxemic patients.

7. Large doses of none of the extracts of the posterior lobe of the pituitary should be given routinely to toxemic patients after delivery. If bleeding is anticipated or occurs, ergonovine is probably preferable.

8. Our conclusions are based on a comparatively small number of patients, but the fact that the "pituitrin test" may aid in differentiating preeclampsia from other toxemias of pregnancy warrants further investigation to definitely determine its value. Furthermore, its use early in pregnancy may enable us to detect the patients who may subsequently develop preeclampsia.

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"RETROGRADE" ABDOMINAL HYSTERECTOMY WITH AVASCULAR MORCELLATION FOR LARGE FIBROIDS

I. C. Rubin, M.D., F.A.C.S., New York, N. Y.

(From the Gynecological Service of Mount Sinai Hospital)

THE removal of a fibromyomatous uterus by morcellation is not a new procedure. It was employed even before the modern method of hysterectomy was fully developed. Morcellation in combination with the standard technic through a relatively small incision has also been practiced, particularly by European gynecologists. The tumor mass was reduced in size until the remnant of the tumor-bearing uterus could be delivered through the abdominal wound after which it was removed in the typical manner.

The advantage which this technic offered the patient, by conserving as much of the abdominal wall as possible, was, however, offset by the considerable amount of blood lost during the process of cutting up the tumor masses. The operation has therefore been abandoned and now

one generally employs an incision large enough, even though it extends well above the umbilicus, in order to liberate the tumors.

To obviate the blood loss entailed by the preliminary morcellation as previously practiced, at the same time conserving the abdominal wall, I have in the past two years employed in six cases the method presently to be described.

PROCEDURE

The incision is entirely subumbilical. In four of the six cases, although the fibroids reached well up into the epigastric space, the incision was below the umbilicus. The vesicouterine peritoneum is picked up and incised to extend

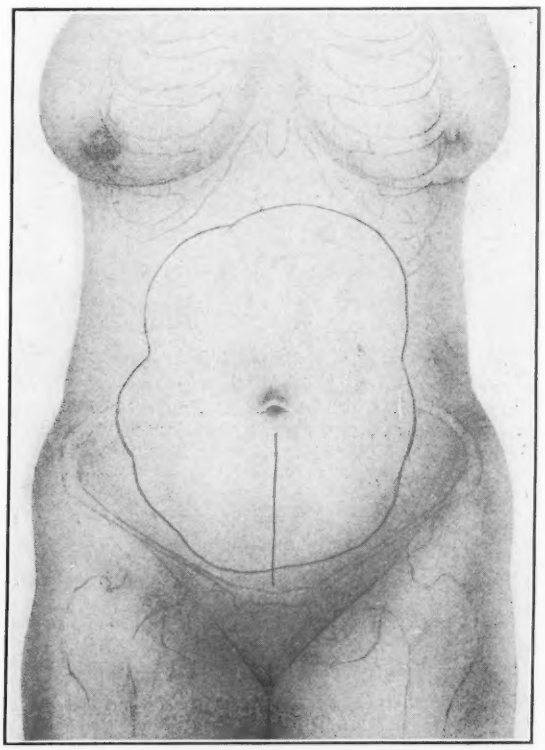

Fig. 1.—Outline of large myomatous uterus reaching the epigastric space in relation to the median suprapubic incision.

to each round ligament which is divided between two ligatures (Fig. 2). If the adnexa are to be removed they are ligated and severed from the infundibulopelvic ligament. If they are to be retained they are clamped off at the uterine attachment and secured by ligatures (Fig. 3). The age of the patient and the condition of the adnexa determine the one or the other step.

The uterine vessels are ligated on both sides, or first on one side, followed by amputation of the cervix. Then the vessels of the other side may be grasped and ligated (Fig. 4). This step is quite the same as that employed by Kelly, Doyen and others, except that the myomatous uterus by the present method is allowed to remain within the abdomen for a few minutes after it is completely severed from its cervical attachment and blood supply. When the tumors are mostly situated

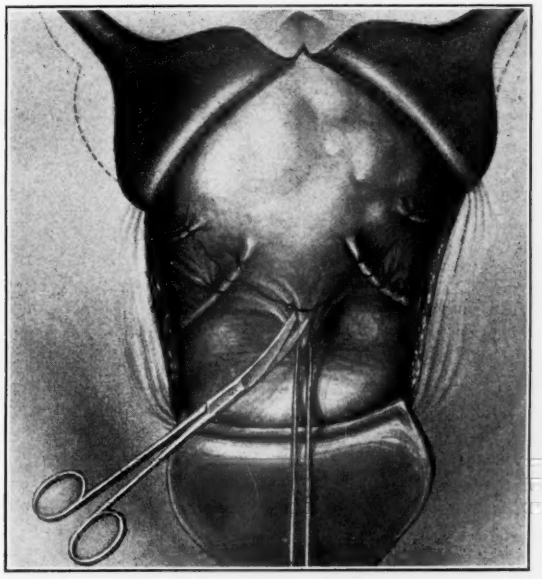

Fig. 2.—Line of incision through vesicouterine peritoneum and across round ligaments. The bulk of the myomatous uterus is in situ, preventing protrusion of intestines.

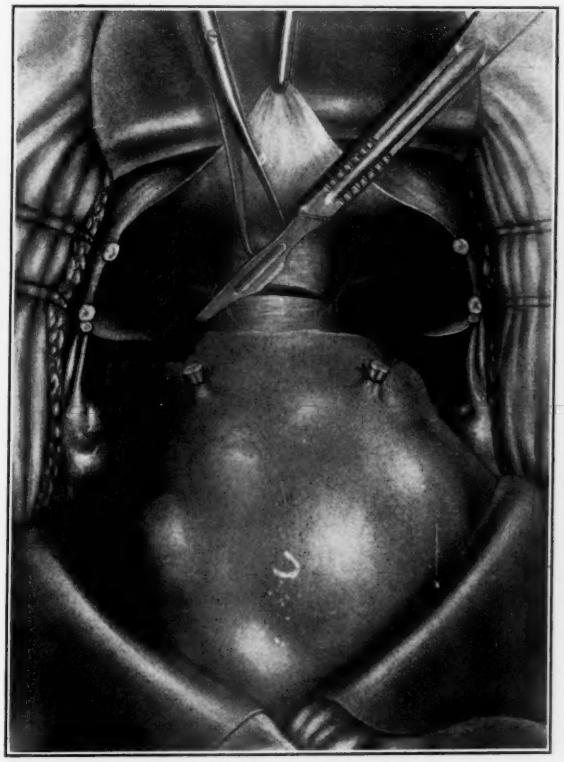

Fig. 3.—The adnexa have been ligated and severed from the uterus; the uterine vessels ligated. Cervix is cut across.

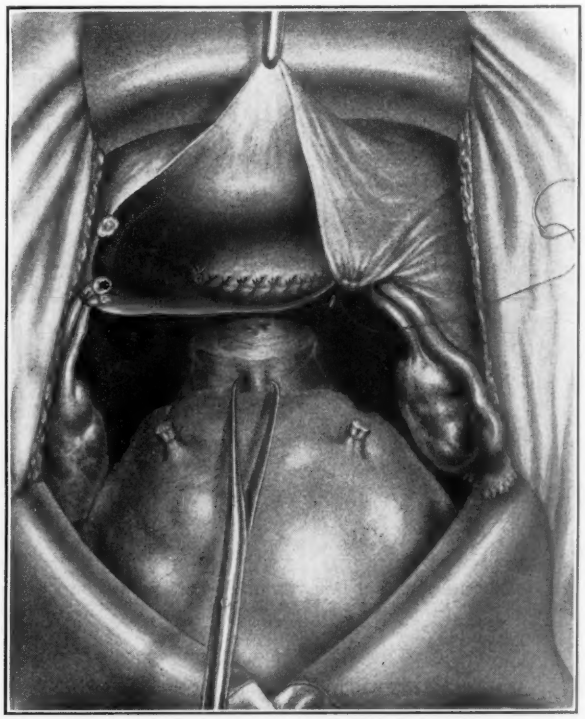

Fig. 4.—The cervix stump sutured and peritonealized together with the adnexal and round ligament stumps.

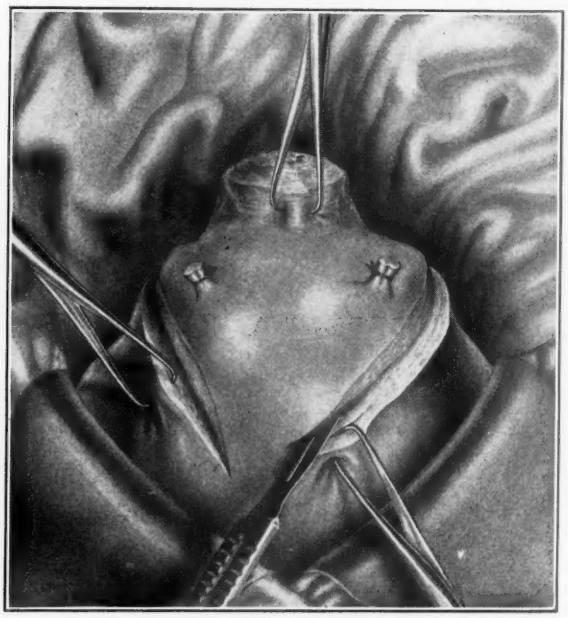

Fig. 5.—The uterus is brought through the wound and a fairly large segment is excised bloodlessly.

above the round ligament attachments and especially at the fundus, the cervical amputation is exceedingly simple. When the fibroids are intraligamentous and fixed by adhesions, care must be taken to get into the proper plane of cleavage, avoiding bladder and ureters, a precaution important in any method of hysterectomy. This step, however, offers no greater difficulty than when the uterus is actually delivered out of the wound.

After proper disinfection, the cervix stump is sewed over and with it the round ligaments and adnexal stumps are peritonealized as in the usual technic (Fig. 4.) A pad is placed against the pelvic peritoneum. Each side of the abdominal wound is retracted by the heavy curved retractors.

The detached uterus, which has been allowed to remain in the abdomen, is now pulled through the wound by volsellum forceps and is removed piecemeal bloodlessly (Fig. 5). There need be no great hurry in doing the morcellation. The intestines are entirely out of sight. The tumor segments may be excised outside of the abdominal wound in accordance with their number, size, and distribution (Fig. 6). This proceeds until the entire uterus has been extirpated. Adhesions can be dealt with properly. The omentum, if long enough, is brought down to underlie the abdominal incision. Closure of the abdominal wound is typical.

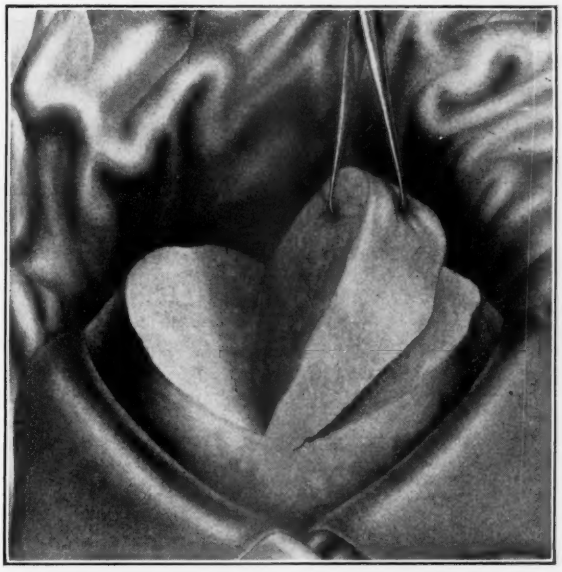

Fig. 6.—The rest of the uterus is removed in segments.

COMMENT

The feasibility of the method will be grasped at once by the experienced pelvic surgeon. Should greater difficulty be encountered than has been anticipated, or should a malignant degeneration be suspected, it is always possible to extend the incision and then complete the hysterectomy. In one of my cases clamps were applied to the uterine vessels followed by bloodless morcellation, which made it possible to bring the much reduced uterus through the wound, after which it was amputated as in the typical hysterectomy. In two other cases I was able to remove a large peduncu-

lated fundal fibroid in retrograde fashion by morcellation after ligating the pedicle and dividing it in one case, and clamping followed by division in the other. It was a simple procedure to reduce the size of the fibroid until it could be delivered easily through a relatively small abdominal incision.

The advantages of this procedure may be briefly stated:

1. The smaller incision, all other things being equal, serves to prevent large hernias.

2. As the fibromyomatous uterus is allowed to occupy its natural position during the operation, it acts as a nonirritating pad which prevents the intestines from prolapsing into the wound and from being traumatized.

3. Shock is lessened because of this circumstance and by reason of the fact that the large tumor mass is not at once delivered out of the abdominal wound.

4. Postoperative comfort appears to be comparable to that which follows the average uncomplicated vaginal hysterectomy, two principles of which are utilized in the present technic.

Over the vaginal route, it has several advantages besides the general one of thorough abdominal exploration. It affords the possibility of removing fibroids which reach as high as the xiphoid. The cervix may be retained, leaving intact the vaginal vault. Periuterine adhesions are more readily dealt with and the adnexa may be removed with greater facility, especially when they are adherent.

911 Park Avenue

Meyer, Robert, and Rockstroh, Herbert: Mucocele and Myxoglobulosis of the Appendix and Pseudomyxoma of the Peritoneum, Ztschr. f. Geburtsh. u. Gynäk. **112:** 125, 1936.

The authors report several of these rare conditions of the appendix. The etiology of a mucocele presupposes a closure of the lumen with an abnormal production of mucus. Myxoglobulosis, a variety of mucocele, results from the formation of globoid bodies from the mucus. Pseudomyxoma of the peritoneum is frequently produced by the perforation of a mucocele or myxoglobulosis. The authors do not believe that rupture takes place directly as a result of internal pressure, but that the pressure must be augmented by an inflammatory reaction. Pseudomyxoma of the peritoneum may also be caused by the rupture of pseudomucinous cysts of the ovary. A case of pseudomyxoma of the peritoneum produced by the rupture of a mucocele in the presence of bilateral ovarian pseudomucinous cystomas is reported as well as one case each of pseudomyxoma of the peritoneum arising from the appendix and the ovary respectively.

E. S. Auer.

THE RELATION OF AFTER-PAINS TO UTERINE CONTRACTIONS FOLLOWING ADMINISTRATION OF PROGESTIN

SAMUEL LUBIN, M.D., F.A.C.S., FRANK J. CLARKE, B.A., M.D., AND SAMUEL R. M. REYNOLDS, M.A., PH.D., BROOKLYN, N. Y.

(From the Obstetrical Service of Cumberland Hospital, and the Department of Physiology, Long Island College of Medicine)

RECENT experiments have shown that the administration of progestin to women having after-pains brings relief in most cases (89 per cent) within a few minutes to an hour (Lubin and Clarke, 1936). The present study was made to ascertain the extent to which this pain-relief is associated with abatement of uterine contractions.

It is well known clinically that after-pains are associated with intermittent uterine contractions, as stated by Williams (1930). Such painful contractions have been recorded recently during the early puerperium by Antoine (1935). It has also been observed that progestin given to women on the seventh day of the puerperium effectively inhibits uterine contractions within a few minutes (Falls, Lackner and Krohn, 1936). In this respect the inhibitory effect of progestin on the human myometrium parallels its effect upon rhythmic uterine contractility in unanesthetized rabbits (Reynolds and Allen, 1932; Allen and Reynolds, 1935) except that the onset of inhibition is more prompt in the human being.

Although after-pains are known to be associated with uterine contractions, it is equally well known that intermittent uterine contractions may occur at certain times (e.g., Braxton Hicks; puerperal, etc.) without being associated with pain. Clearly, therefore, the relief of after-pains by administration of progestin may or may not be dependent upon the abatement of uterine contractions. Determination of this point was undertaken in the present study by using the external hysterographic method of Dodek (1932) and correlating the onset and extent of pain-relief with the type of uterine contractions found after intramuscular injection of one rabbit unit (Corner-Allen unit) of progestin.

PROCEDURES

Ten patients have been studied in this investigation, seven of whom received progestin[1] after a period during which motility was recorded. The remaining three have been used for control purposes and received no progestin. Careful selection of

[1]Three different commercial preparations of progestin have been used in the study of after-pains. They may be described as follows: *(A)* Domestic product from natural sources. This product is not crystalline material. One lot was highly active, and most used in this work (Lubin and Clarke) thus far. A second lot recently tested was only moderately effective in relieving after-pains. (B) A nonerystalline foreign product from natural sources, which failed to alter the intensity of the after-pains. *(C)* A crystalline domestic preparation. Used only to a slight extent thus far, but highly effective in the relief of after-pains.

the patients was made following the procedure adopted by Dodek and by O. W. Barlow.[2] A retention catheter was inserted for the duration of the period of observation.

In the initial recording period, the duration, frequency and amplitude of the contractions were ascertained. At the same time it was possible to learn from the patient, who was not in position to observe the kymograph, the onset, duration, and relative intensity of the pains. The patients described the quality of the pains in various ways such as "bad," "severe," "not bad," "mild," "crampy," etc.

The patients were used four to twenty-four hours postpartum, with the exception of one who received progestin forty-eight hours after parturition during all of which time there were severe after-pains. These subjects were comparable to the ones used in the more extensive series reported previously (Lubin and Clarke, 1936). Each was a multipara, nonmorbid, and had delivered spontaneously. Only one experienced slight hemorrhage at the time of parturition; the bleeding was controlled by pituitrin and ergotamine tartrate. Inasmuch as the effect of progestin at this early time in the puerperium on involution, red cell count, hemoglobin con-

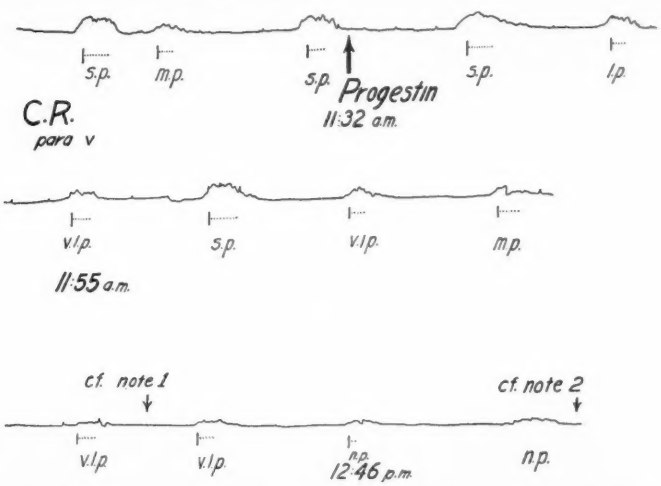

Fig. 1.—Continuous records of uterine contractions from patient C. R. (cf. Table 1), aged twenty-six, para v, ten-hour labor; records taken forty-eight hours postpartum. Abbreviations are: *s.p.*, severe pain; *m.p.* moderate pain; *l.p.*, little pain; *v.l.p.*, very little pain (nearly nil); *n.p.*, no pain.

Progestin administered at 11:32 A.M. Mild pains twenty minutes later. Onset of pain shown by vertical line under each contraction, and duration indicated by dotted line. Patient had severe pains all night, said "Pains are worse than having a baby." No return of pain in twenty-four hours.

centration and lactation was considered in the other series, these factors were not recorded at this time. Suffice it to say that the puerperal course was normal in each instance.

RESULTS

The results are briefly summarized in Tables I and II. Here it will be seen that at the outset, in each of the seven patients receiving progestin, uterine contractions of one-half to four minutes in duration oc-

[2]Doctor Barlow advised us in detail concerning the necessity of selecting patients with thin abdominal walls and easily palpable uteri. Furthermore, the patients must be cooperative. This latter requirement was somewhat difficult to fulfill inasmuch as the after-pains made a number of the patients unable to lie quietly for as long a time as was necessary in these experiments (one to four hours). For this reason many patients were utilized only to be discarded because of failure to complete the records.

curred at intervals of from four to twenty minutes. The pains occurred during part of these contractions, as noted below.

Pain-Relief.—Relief from the after-pains was obtained in each instance after the use of progestin. As a rule, the pains were noticeably milder within fifteen minutes or less, and were reported to be very mild or absent within one-half to one hour following the injection. As noted in the earlier larger series, the pain-relief persisted with only occasional recurrence at the time of nursing in some instances.

Uterine Contractions After Progestin.—In none of the seven patients receiving progestin did motility cease within the time of recording. It did become distinctly less in three patients, however, and slightly less in one. This change affected the amplitude (height) of the recorded contractions, and in one instance (S. G.), the frequency also. The reduction in amplitude was relative to the amplitude of the pre-injection motility. It may be noted also that the external hysterographic technic does not record all phases of the uterine contractions but only those which are localized under the plunger of the recording apparatus. Nevertheless, the duration and

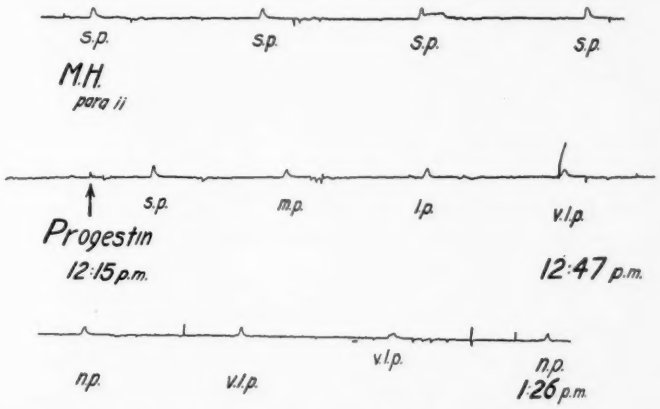

Fig. 2.—Patient M. H. (cf. Table I). Para ii, thirty-eight hour labor, spontaneous delivery, eighteen hours postpartum. Abbreviations as in Fig. 1.
Progestin given at 12:15 P.M. Mild pains in twenty minutes, nil in thirty-five minutes. Had after-pains all night and morning. Pain relieved when contractions persisted, with only slight decrease in amplitude. Pains began after contraction started and outlasted the period of relaxation (cf. text). At 12:47 patient coughed, giving large deflection of writing point.

frequency of the contractions were not significantly altered in any case receiving progestin, and in two of the three uninjected patients the contractions diminished spontaneously.

The time of onset of the reduced amplitude of contractions deserves special comment; it did not become significantly less within three-fourths of an hour in any instance. Thus the pain-relief preceded recognizable changes in the height of contractions. In four of the patients, moreover, there was pain-relief but no significant change in the type of the contractions observed. *Clearly, therefore, relief of after-pains following the use of progestin is not necessarily associated with striking changes in motility, as gauged by this method of recording uterine contractions.*

Falls, Lackner, and Krohn (1936) find with the intrauterine balloon method of recording that one will obtain cessation of uterine contractions following progestin on the seventh day of the puerperium. This inhibition takes place within a short time after the administration of even smaller amounts of progestin (1 Clauberg unit) than were used in our experiments. Perhaps some difference in sensitivity

TABLE I

OCCURRENCE OF AFTER-PAINS AND UTERINE CONTRACTIONS IN WOMEN WITH PROGESTIN THERAPY

PATIENT	PAIN		UTERINE MOTILITY		END-RESULTS		REMARKS
	BEFORE PROGESTIN	AFTER PROGESTIN	BEFORE PROGESTIN	AFTER PROGESTIN	PAIN	MOTILITY	
S. G.	Severe	Less severe in 15 min.; very mild in 1 hour	1 min. duration. 4 min. intervals	1 hr. later, very weak contractions with each mild pain. Duration same, and frequency increased	Relieved	Decreased	Para iii, 7 hr. labor, spontaneous delivery. Slight hemorrhage at labor, controlled by pituitrin and gynergen. 4 hours postpartum
I. M.	Severe	Less severe in 25 min. and continued mild	2 min. duration. 15 min. intervals	No change	Relieved	No change	Para ii, 9 hr. labor, spontaneous delivery. 48 hr. postpartum
N. N.	Severe	Less severe in 6 min.; mild in 45 min.	2 min. duration. 6 min. intervals	No change	Relieved	No change	Multipara, 12 hr. labor, spontaneous delivery 24 hr. postpartum
R. P.	Moderate	Less severe in 45 min.; mild in 1 hr.	2-3 min. duration. 5 min. intervals	1 hr. later, reduced amplitude; duration and frequency same	Relieved	Decreased	Para ii, spontaneous delivery. Severe pains all day before. 24 hr. postpartum

TABLE I—CONT'D.

C. R.	Severe	Mild in 20 min. Nil in 1 hr. Grateful for relief	2-3 min. duration. 10 min. intervals	Weak 1 hr. later, duration and frequency unaffected	Relieved	Decreased	Para v, 10 hr. labor, spontaneous delivery. Had severe pains all night. 24 hr. postpartum
M. S.	Moderate	Less severe in 8 min.; very mild in 1 hr.	2 min. duration. 5 min. intervals	No change	Relieved	No change	Para ii, 3 hr. labor. 15 hr. postpartum
M. H.	Severe	Less severe in 15 min.; very mild in 35 min.	½ min. duration. 15 min. intervals	Slight weak	Relieved	Slight decrease	Para iii, 38 hr. labor; pain all night and morning. 18 hr. postpartum
Controls							
E. N.	No real pain. Felt each contraction		1 min. duration. 5 min. intervals				Para iii, 4½ hr. labor, spontaneous delivery, contractions decreased spontaneously, waiting to use progestin
G. F.	Cramplike		2 min. duration. 10 min. intervals				Para iii, 17 hr. labor, spontaneous delivery. Nervous; weak; contractions decreased spontaneously, waiting to use progestin
M. M.	Mild		4 min. duration. 15 min. intervals				Para i, 6½ hr. labor, spontaneous delivery premature. Contractions did not disappear; no progestin used

of the uterus at that time (seventh day of the puerperium) or some difference inherent in the two methods of recording may account for the variations in intensity and onset of inhibition recorded by the two methods respectively.

Occurrence of After-Pains in Relation to Uterine Contractions.—The relationship between the time of onset of the after-pains and of onset of the contractions was frequently noted. It was found that pain became evident as the contraction approached its peak. A similar situation is frequently encountered during labor, at which time uterine contractions may be palpated before the associated pains are experienced by the patient. In some instances the pain persisted through the highest portion of the contraction, whereas in others it continued well into the relaxation phase of the contraction.

TABLE II

SUMMARY OF DATA OF TABLE I

PAIN		UTERINE CONTRACTIONS	
Relieved	7	Diminished	3
Unrelieved	0	Slightly diminished	1
		No change	3

DISCUSSION

The present results confirm the earlier ones in showing that after-pains may be relieved by suitable administration of progestin. This pain, however, is relieved before significant diminution of motility takes place, as revealed by the external hysterographic method. A question naturally arises, therefore, concerning the mechanism by which the pain is brought about. By what functional change is pain-relief achieved, since contractions of considerable force occur when the pains commence to subside?

In this connection reference may be made to the experiments of Moir (1934). This investigator found that in a young woman having intense menstrual pain, the onset of pain was coincident, not with the beginning of the contraction, but with the occurrence of an intrauterine pressure which exceeded the level of systolic blood pressure, taken simultaneously in the brachial artery. Because of this fact, he suggests that the pain may arise as a result of prolonged ischemia of the uterus during the contraction phase of its activity. Painter and Harne (1936) find a somewhat similar situation in the case of sensory disturbances resulting from experimental alteration of intrauterine pressure in the rat.

In view of these considerations, as well as our own observation on the time of onset of pain, it seems reasonable to explain the results of the present study on the grounds that ischemia of the uterus occurs during the contraction phase to such an extent that pain results, and that progestin in some way relieves the extent of the ischemic condition in the myometrium. Our data do not prove this although they do provide a basis upon which relief of uterine pain by means of progestin may be tentatively explained.

CONCLUSIONS

1. After-pains may be relieved by intramuscular injection of 1 rabbit unit (Corner-Allen) of progestin.

2. Pain-relief begins prior to any significant alteration in uterine contractions, as revealed by the external hysterographic method of recording.

3. The mechanism by which after-pains are produced is considered and the nature of the relief from them following progestin therapy is discussed.

4. It is tentatively concluded that the relief of uterine pain following injection of progestin is associated with prevention (completely or relatively) of an ischemic condition within the uterus during a portion of its contraction phase.

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A FIVE-YEAR STUDY OF INCOMPLETE ABORTIONS AT THE SAN FRANCISCO HOSPITAL

R. D. Dunn, M.D., San Francisco, Calif.

(From the Department of Obstetrics and Gynecology, Stanford University School of Medicine, and the San Francisco Department of Public Health)

A LARGE proportion of the patients admitted to the Stanford Gynecologic Service at the San Francisco Hospital suffer from the effects of incomplete abortion. The majority of these abortions are self-induced, and consequently are usually accompanied by infections of varying severity. There always have been two opposed modes of treatment of this extremely common condition, viz., the conservative and the radical. Since there still exist considerable confusion and divergence of opinion as to what constitutes the most efficacious and least dangerous method of treatment, we believe that a report of the results of our mode of therapy may be of interest. The method followed by us was adopted some twenty years ago, and differs in some respects from the generally accepted orthodox principles laid down for the treatment of abortion. The results published here cover the last five years.

Although our method of treatment must be classed as radical, we believe it to be as safe, or safer than the ultraconservative procedures.

We make this assertion, first, because our results are good, and second, because the length of hospitalization is considerably less than is ordinarily estimated for patients treated conservatively.

METHOD

Our routine is as follows: The general physical and pelvic examinations, together with laboratory findings, are used to determine the condition of the patient. Especial note is made of the amount of bleeding, amount of dilatation of the cervix, size of the fundus, and degree of tenderness of the parametrium and peritoneum. If placental tissue is protruding from the cervical os, it is removed with aseptic precautions. If there is little or no bleeding and the fundus is only slightly enlarged, or if there is a history of expulsion of the products of gestation, the patient is put under observation and treated expectantly. Patients who bleed moderately or severely are treated surgically without delay unless marked tenderness of the parametrium or moderate tenderness of the peritoneum is present. Either is always considered a contraindication to surgery. As a rule, the temperature is disregarded, but if fever is accompanied by a pulse rate of over 120, the possibility of a blood stream infection must be considered, and surgical treatment is postponed until the absence of septicemia has been determined.

Our surgical procedure consists of *dilatation and evacuation.* We wish to emphasize the fact that we do *not* curette. After the cervix has been carefully dilated sufficiently to admit a sponge forceps, 1 c.c. of obstetric pituitrin is given intramuscularly. As soon as contraction of the fundus has taken place, permitting the uterine cavity to be easily outlined, a sponge forceps or a placental forceps is used to remove the products of gestation. This is done very gently because of the danger of perforation, even with the use of such blunt instruments. After the uterine cavity is grossly empty a fairly large, blunt curette is used to *sound* the cavity for any large pieces of placenta which may have been left. If such are found, we again employ the sponge forceps for their removal, but we *do not curette.* A gauze pack soaked in a solution of alcohol, glycerin, and formalin* is gently inserted into the uterine cavity and allowed to remain for twenty-four hours. This is an effective means of removing any small adherent placental remnants, and at the same time it hastens coagulation of the surface of the uterine cavity. Occasionally an alarming hemorrhage occurs as soon as the operative procedure is begun, in which event all attempts at evacuation are immediately discontinued, and the uterus is tightly packed. After twenty-four hours, evacuation usually can be accomplished without further difficulty.

RESULTS

In the five-year period covered by this report (March, 1930 to March, 1935), 730 patients with incomplete abortions were admitted to the Stanford Gynecologic Service of the San Francisco Hospital. Of these, 605 were treated by *dilatation and evacuation,* with an average hospital stay of 6.02 days per patient. Three of these patients reentered the hospital because of recurrent bleeding, and were again treated surgically. The remaining 125 were treated conservatively, either because of little or no bleeding or because of infection extending beyond the uterus. For this group, the average hospital stay was 14.4 days per patient. Seventeen of the patients who received conservative therapy returned because of recurrent bleeding, and *dilatation and evacuation* was performed.

Infection was present clinically in approximately 85 per cent of all cases, as evidenced by fever and leucocytosis. Microscopically, 72 per cent of the placental tissue showed infection (Table I).

*Alcohol 95 per cent 10 ounces, glycerin 6 ounces, formalin 10 per cent 10 drops.

Pelvic abscesses occurred in three patients, and were treated by drainage through posterior colpotomy incisions. One of these patients died, probably from exsanguination rather than from sepsis. The other two had uneventful immediate recoveries from drainage of the abscesses, but subsequently were operated upon for low-grade pelvic inflammatory disease which undoubtedly resulted from the infected abortions.

Vaginal hysterotomy was performed on one patient approximately four months pregnant, because of excessive bleeding and resistance of the cervix to mechanical dilatation. We consider hysterotomy a valuable procedure when pregnancy has advanced to the second trimester if the cervix is very long and will not yield to dilatation. Accidents of pregnancy of more than sixteen weeks are not included in this report.

TABLE I

Number of incomplete abortions	730
Treated by dilatation and evacuation	605
Average stay in the hospital	6.02 days
Treated conservatively	125
Average stay in the hospital	14.4 days
Reentries after dilatation and evacuation	3
Reentries after conservative treatment	17
Infected cases	525 (or 72%)
Gross mortality	5 (or 0.68%)
Corrected mortality	3 (or 0.41%)

A hemoglobin of 50 per cent or less, determined by the Sahli standard, was considered a definite indication for blood transfusion, although we were not always able to obtain donors for these indigent patients. Whenever possible, transfusion should be given in order to raise the general resistance to infection.

There were five deaths in this series of 730 patients, constituting a mortality of 0.68 per cent. This figure may be corrected to 0.41 per cent, since two of these patients were admitted in extremis and died before adequate treatment could be instituted. The other three presented pictures of general septicemia on admittance, and as a result died within eight days.

SUMMARY OF MORTALITY GROUP

1. A. H., aged thirty-six years, three months pregnant. No history of abortion admitted. On entry, temperature 99.8°, pulse 138, and respiration 30. *Dilatation and evacuation* performed because of profuse bleeding. Died six hours after entry. Coroner's autopsy showed pelvic abscess with old perforation of uterus, incomplete abortion.

2. E. L., aged twenty-nine years, four months pregnant. Used slippery elm four days prior to entry. On entry, temperature 100°, pulse 90, and respiration 24. Abdomen moderately tense. Uterus and adnexa tender. Given general supportive measures. Died forty hours after entry. Coroner's autopsy showed peritonitis and septicemia following abortion.

3. G. C., aged thirty-six years. No history obtained. On entry, temperature 102°, hemoglobin indeterminable. *Dilatation and evacuation* performed, with transfusion of 750 c.c. whole blood. Died six hours after entry. Coroner's autopsy showed incomplete abortion, sepsis, exsanguination.

4. A. H., aged twenty-seven years. Did not admit abortion. History of bleeding for two weeks after three months amenorrhea. On entry, temperature 102°, pulse 134, and respiration 36. Vomiting, abdomen tense, chest clear, no severe bleeding. Given general supportive measures. Gradual downhill course with high temperature and pulse. Died eight days after entry. Coroner's autopsy showed peritonitis and endometritis, bilateral salpingitis and oophoritis.

5. A. R., aged twenty-five years. Entered and refused treatment. Reentered four days later with profuse bleeding. On entry, temperature 103°, pulse 130, and respiration 30. Fundus large and boggy, with much induration in the parametrium. *Dilatation and evacuation* performed, with transfusion, which was repeated twenty-four hours later. Died five days after entry. Coroner's autopsy showed septic abortion.

DISCUSSION

On the basis of the results reported here, we feel that our method of treating incomplete abortion is both satisfactory and safe. However, may we emphasize again that we do not advocate radical curettage, but follow a middle course by evacuating the uterus with as little trauma as possible. We are convinced that emptying the uterus of infected material by the above-described technic decreases the chance of extension of infection to the parametrium and peritoneum, lessens the likelihood of a septicemia, shortens the period of hospitalization, reduces blood loss, and expedites recovery.

TABLE II

AUTHOR	NO. CASES	TYPE OF TREATMENT	MORTALITY
Reichelt, H.	1870	Conservative and radical	2.02%
Sommer, K., and Ziegeler, H.	1150	Conservative	2.00%
Olow, J.	740	Radical	0.40%
Harbitz, H.	3791	Conservative and radical	2.16%
Watkins, R.	341	Conservative	0.88%
Balslev, L.	1600	Conservative	7.08%
Schroeder, R., and Clauberg, C.	473	Conservative	1.00%
Hillis, D.	1000	Radical	2.00%
Winter, H.	6512	Radical	3.08%
Tuttle, H.	1164	Radical	2.23%

Table II gives the mortality figures of the largest series of cases reported in the last ten years. It is evident that there is no appreciable difference in the number of deaths reported for conservative and for radical treatment. Our mortality of 0.68 per cent compares very favorably with the lowest figures reported. Other factors, such as periods of morbidity, hospital days, and after-effects, are not easily compared with reports of other observers because of lack of figures in certain publications.

Miller and Bubis advocate conservative treatment, but give no statistics. Gellhorn and Harbitz suggest a compromise between the conservative and the radical methods, while Schulze, Olow, and Wahl make a plea for the radical procedure. Watkins is of the opinion that conservative treatment is the procedure of choice, contending that curettage favors the spread of the infection to the parametrium, thus lengthening the period of convalescence. It is interesting that he stresses the rapid decline in temperature following spontaneous expulsion of the uterine contents, a result which also has been very evident in our method of treatment. Schulze, on the same basis, favors radical treatment. He contends that emptying the uterus of its foreign and infected material stimulates it to contract and controls bleeding, and thus conserves the patient's energy, giving her a chance for a more rapid recovery.

Witherspoon reports 200 cases with 7 deaths due to perforation of the uterus, an accident which is negligible in our series, and, we believe, avoidable, provided all points described in our technic are rigidly observed. In our study of 730 abortions, only one death occurred from perforation, and this was probably the result of the patient's own attempt at abortion, since the autopsy showed an *old* perforation.

Whether our procedure is followed by a low-grade parametritis after the patients leave our care is difficult to ascertain. It seems to us that infected, necrotic placental tissue, if allowed to remain in the uterus for any length of time, is more likely to invite parametritis than if gently removed with the least possible traumatization of tissues. Since very few of our patients have been readmitted to the hospital service or have attended the clinics for prolonged after-treatment, we have concluded that our incidence of extrauterine infection is low.

CONCLUSIONS

1. A middle course between conservative and radical measures is advocated for the treatment of incomplete abortion, as exemplified by *dilatation and evacuation.*

2. A comparative study of 730 patients, 605 of whom were treated surgically and 125 expectantly, shows that such a procedure is both safe and expedient.

3. The method of treatment described shortens the period of hospitalization.

4. The mortality rate following this procedure is comparatively low.

5. Extension of infection beyond the uterus or the presence of septicemia is a contraindication to *dilatation and evacuation.* Such cases should be treated expectantly.

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REACTIONS OF HUMAN UTERINE MUSCLE IN VITRO TO PITUITRIN, ADRENALIN AND ACETYLCHOLINE AND THEIR RELATIONS TO THE MENSTRUAL CYCLE

EDGAR G. MILLER, PH.D., JESSIE REED COCKRILL, M.D., AND RAPHAEL KURZROK, M.D., PH.D., NEW YORK, N. Y.

(From the Department of Biochemistry, the Department of Obstetrics and Gynecology, and the Sloane Hospital for Women, the College of Physicians and Surgeons, Columbia University.)

MUSCLE strips, approximately 10 by 3 by 3 mm., from human uteri obtained at operation in Sloane Hospital, were examined. These were suspended, by the usual technic for kymograph recording, in 100 c.c. of Ringer's solution at 37.5° C. The lever weight and the magnification on the kymograph record were constant. The spontaneous rhythms of about 350 of these strips and their responses to the addition to the Ringer's solution of pituitrin (0.5 c.c., 5 units) were recorded. More than five hundred strips were also studied with adrenalin (0.1 c.c. of a 1:1,000 solution) and acetyl choline (50 mg. of the hydrobromide). The clinical history and examination of the endometrium, and frequently of the ovary, indicated for each case the time in the menstrual cycle at which the specimen was obtained. All days of the cycle were represented except the second to the fifth (as a rule, operations are not performed during menstruation). With a few exceptions which will be noted later, only uteri within the childbearing age were used. No uteri with demonstrable pathologic conditions were used, with the exception of some in which one or two small fibroids occurred.

If the strips showed no spontaneous rhythmic contraction within an hour after they were set up in the recording apparatus, they were discarded. Such lack of motility may possibly be due to differences in the conditions of the hysterectomy (the anesthesia was gas-oxygen and ether in almost all cases). It definitely did not correlate with the time in the menstrual cycle, nor the time elapsed since the operation.

Strips from different uteri, set up in parallel in the same suspension cylinder, exhibited their different rhythms independently. Parallel strips from the same uterus usually showed the same rhythm. It was repeatedly noted that a strip contracting rhythmically and untreated may abruptly and spontaneously alter its rhythm, both as to timing and magnitude of excursion. Such changes may occur several times with one strip, and at any period during the time that it retains its activity. These observations throw doubt on the suggestions which have been made concerning the correlation of type of contraction-rhythm with the time of the menstrual cycle; we have found no indication of such a rela-

tion. Also, in repeated comparisons with strips taken from different layers or in different planes from the same uterus, we found no consistent differences. We could not relate the occurrence of these variations with the menstrual cycle nor with any other observable variable.

Approximately 90 per cent of the uterine strips contracted when treated with pituitrin. This response occurred throughout the cycle; it was noted, however, that from about the twentieth day on there was an increase in the magnitude of the response. On 10 per cent of the strips pituitrin had no effect; there was no correlation between this lack of response and the time in the cycle, such cases being found at any period. In one case only (on the eleventh day of the cycle) pituitrin caused relaxation. These results appear to contradict the conclusions of Knaus concerning the close relationship between corpus luteum function and the time in the cycle and the reactivity of the uterine muscle to pituitrin.

It was observed that repeated washing of a muscle with Ringer's solution might alter its reactivity. Such treatment in some cases activated an inactive uterus; in other instances it abolished, and in others increased, the subsequent response to pituitrin.

Adrenalin contracted 88 per cent, had no effect on 2 per cent, and relaxed 10 per cent, again without any correlation between the time in the menstrual cycle and the occurrence of atypical responses. Acetyl choline caused contraction in all cases, but with considerable variability in intensity of response. With both of these drugs it was observed that the magnitude of response tended to increase from about the twentieth day on, although this was not as marked as in the case of pituitrin.

Twelve strips which were treated with atropine (in amount not in itself causing any alteration of the normal rhythm) responded to subsequent adrenalin treatment by relaxation.

Addition of ergosterol to the Ringer's solution, in 9 of 12 cases so treated, abolished the response to subsequent acetyl choline treatment. This is in accord with the observations of Carter and Mapson on the interaction between sterols and acetyl choline in frog gastrocnemius and heart muscle. In 3 cases the ergosterol caused a reversal of the response; thorough washing with Ringer's solution abolished this reversal.

Strips from 6 postmenopause uteri were tested. Their tone was unstable, their rhythmic contraction feeble or lacking, and their responses to the drugs were slight or absent. A seventh case gave different results. This was a uterus from a woman sixty-three years old, fifteen years postmenopause. The pathologist's report indicated a cystadenoma of the ovary; there were numerous metastatic growths throughout the pelvis and abdomen. The muscle showed rhythmic activity and the drug responses, which were of the type normal for premenopause uteri,

were rather enhanced in magnitude. This case seems to be of interest in view of the observations of Novak on evidence of "genital rejuvenation" with granulosa cell tumors of the ovary.

Robson has reported interesting studies on the relation of estrin to uterine reactivity. In vitro tests with the human muscle addition of amniotin (probably a mixture of estrogenic substances) to the suspension fluid gave no marked effects, although the tone of the strip seemed to be stabilized; in some cases a diminution of the speed and amplitude of the rhythm appeared, while in other cases, in which the rhythm was unaffected or increased, the intensity of response to the drugs appeared to be somewhat enhanced.

These observations illustrate the frequent variability of reaction of uterine muscle to a given drug dose. They are consistent with the view that the response may be conditioned by the hormonal balance of the tissue, but they cannot be reconciled to the hormonal and menstrual cycle relations as claimed by Knaus. They also, when compared with the recorded results on rabbit and other uteri, add emphasis to the difficulty of transferring conclusions obtained from data on other species to the physiology and pharmacology of the human uterus. We believe also that the data on adrenalin and acetyl choline must be interpreted simply as relating to the action of these as drugs on the cell rather than necessarily implying the intervention of nerve end-structures of sympathetic or parasympathetic type.

We are indebted to Professor Benjamin P. Watson for constant encouragement and advice, and for his placing the large material of the Sloane Hospital for Women and the Vanderbilt Clinic at our disposal. We also wish to thank Professor Charles C. Lieb and Professor Michael G. Mulinos of the Department of Pharmacology for their kind advice and assistance in both the technic and the interpretation of these results.

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The following suggestions are made to prevent the transmission of syphilis by blood transfusion and to secure for the patient a maximum of safety. The procedure of blood transfusion should be carried out by competent and well-trained men. Institutional work should be guided by a physician who is qualified and who should insist upon a minute examination of blood donors at frequent intervals for the presence of a syphilitic infection. There should be available at all times the facilities of a laboratory wherein the common serologic examinations of donor's and recipient's blood for the presence of a syphilitic infection is conducted. The examination should be made on the day of transfusion. The laboratory reports should be written, and not telephoned. Such reports should be made by a competent technician. All syphilitics are potential transmitters.

C. O. MALAND.

HEART-BLOCK AND PNEUMONIA COMPLICATING PREGNANCY

LOUIS H. SIGLER, M.D., BROOKLYN, N. Y.

(From the Cardiologic Service, Department of Medicine, and the Obstetric Service, Coney Island Hospital)

COMPARATIVELY few cases of heart-block complicating pregnancy were reported in the literature. Greenhill's review[1] up to 1933 shows only 12 reported cases, including his one case. Since then one more case was reported by Bernstein,[2] making a total of 13 cases.

The main reason for this comparative sparsity of case reports is that complete heart-block in itself is an uncommon condition and is more so before the age of forty and in females. The frequency of pneumonia occurring during pregnancy likewise is very small, judging from the reported cases, and the fatality from it is rather high.

I found no references in the literature of the coexistence of heart-block and pneumonia as complications of pregnancy. The following case showing this condition is therefore of interest.

G. C., white, twenty-seven years old, admitted to the Obstetrical Division of the Coney Island Hospital on April 12, 1935, with complaints of cough and bloody expectoration, pain on both sides of the chest on breathing and dyspnea of four days' duration. There was amenorrhea for the past six months with definite signs of pregnancy. The family history was essentially negative. In her past personal history, she mentioned that she was subject to frequent colds, was told that she had heart trouble about two years previously, and that she was pregnant a year before this present pregnancy, at which time she aborted at four months.

The onset of the present illness dated back one week prior to admission, when she contracted a "cold." The nose and eyes were running and there was a dry cough, which later became productive and blood-tinged. This was associated with sharp pain in the chest, more so on the right and more pronounced on deep breathing and coughing. Four days prior to admission, she developed a severe chill which lasted a few minutes.

The physical examination showed her to be in apparent distress. There were marked dyspnea, moderate cyanosis of the lips and dilatation of the alae nasae. Her mentality was clear and she was cooperative. Her temperature was 104.2°, pulse 80, and respiration 60. The blood pressure was 124 systolic and 48 diastolic. Her dental hygiene was poor. The tongue was coated and the pharynx was injected. The lungs showed duliness merging with flatness and diminished breath sounds at the right base. The upper portion of the right base showed bronchial breathing and many fine medium inspiratory râles. There were also dullness and diminished breath sounds over the left lower lobe. The heart was enlarged both to the right and to the left. The sounds were accentuated, P_2 being greater than A_2. There was a systolic murmur heard along the left sternal border with greatest intensity over the mitral area. The uterus extended about 2½ fingers above the umbilicus. Fetal heart sounds were heard at the right lower quadrant, with a rate of 190 and regular. It was difficult to map out the fetal parts. The extremities showed no abnormalities.

The diagnosis was: (1) Lobar pneumonia, (2) seventh month pregnancy, and (3) old rheumatic heart disease in the form of mitral insufficiency.

An x-ray of the chest on April 13, 1935, showed lobar pneumonia and cardiac enlargement. The electrocardiogram on April 16 (Fig. 1) showed second degree heart-block with an auriculoventricular conduction time of 0.32 second. The auricular rate was about 100 and the ventricular about 50 per minute. Aside from this and from a tendency toward left axis deviation, there were no other significant changes.

The patient showed a rapid progressive improvement. The temperature became normal the seventh day after admission and remained so until discharge. The pulse ranged between 84 and 40 per minute.

Fig. 1. Fig. 2.

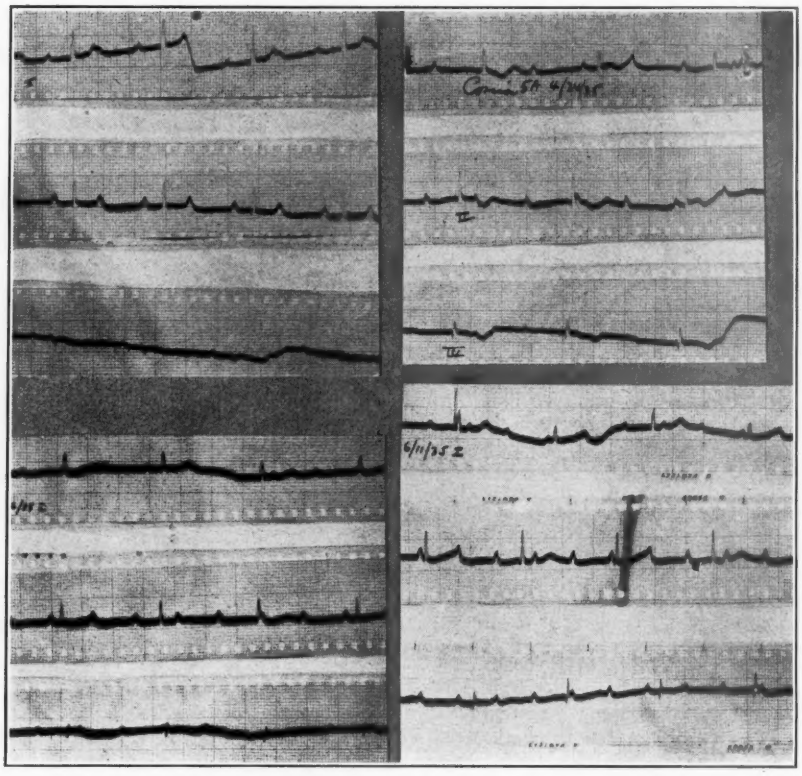

Fig. 3. Fig. 4.

On April 22, the heart appeared to approach the normal in size. The systolic murmur and accentuated first sound were still present. The ventricular rate was about 42 and a faint short sound was heard at the left costosternal junction on and off, in addition to the regular heart sounds, presumably due to auricular contractions. Complete auricuioventricular block was the diagnosis.

It was felt at this time, in view of the absence of a definite history of rheumatism and the questionable reliance on the patient's history of preexisting heart disease, that the heart-block was caused by pneumonia. This opinion was fortified by another electrocardiogram taken on April 24, 1935 (Fig. 2), which showed complete instead of partial auriculoventricular block. In addition, there were changes in the configuration of the ventricular complexes, indicating alterations in the myocardial state. Such changes were negative T-waves in all leads, and diminu-

tion in the tendency toward left axis deviation. This was substantiated by another electrocardiogram done on April 26, 1935, which is not reproduced here and which showed again complete heart-block and further changes in the T-waves. The mitral insufficiency could be explained on the basis of dilatation of the auriculoventricular ring.

The patient was discharged from the hospital improved on April 27, 1935, and was followed in the cardiac clinic. During this time she showed little diminution in her cardiac functional state, although complete heart-block was still present. An electrocardiogram taken in the clinic on May 16, 1935 (Fig. 3), still showed complete heart-block, but there was a slight change of the electrical axis toward the left, and the previously negative T-wave assumed a positive phase in all leads, with a diphasic tendency in the third lead.

The patient was readmitted on June 10, 1935. Her general condition was excellent. A tracing taken one day after the second admission (Fig. 4) showed the T-wave in all leads to be more markedly positive and the electrical axis was within normal limits, indicating further changes and improvement in the myocardial condition. Complete heart-block was still present, however. She was delivered of a normal child on June 12, 1935. The placenta had to be removed manually. She ran a normal postpartum course and was discharged on June 20, 1935.

DISCUSSION

We recognize three degrees of heart-block. The first degree is that in which there is a mere prolongation in the time necessary for the spread of the electrical impulse in the heart; the second, where there is an occasional interruption of the impulse; and the third, where there is a complete interruption of all impulses coming down from the auricles to the ventricles. The last results in complete auriculoventricular dissociation or complete heart-block. The first and second degrees are by far more frequent and less serious than the third degree. The case presented here started as a second degree block and developed later into complete block.

The most common cause of heart-block is degeneration of the heart associated with arteriosclerosis. For this reason, the prevalence of heart-block is much greater after forty years of age. Other causes are various infectious diseases such as rheumatic fever, influenza, pneumonia, diphtheria, syphilis and so on; congenital defects in the conduction apparatus; various intoxications, especially that of digitalis and quinidine; anoxemia, and vagal stimulation. The last may be demonstrated by carotid sinus pressure, which in susceptible individuals may result in reflex vagal block, as I previously described.[3] In our case the condition evidently resulted from the pneumonia, for it started as a partial block and ended in complete block. Besides other progressive changes were noted in the myocardial state in the course of the disease.

The prognosis of heart-block does not depend merely upon its existence but upon the operative causes and associated myocardial disease. Where the etiologic factor is entirely removed and the heart muscle is left in good condition, the prognosis is good. This is true in our case. There are many cases on record where individuals with complete heart-block lived in comparative comfort for many years. Among the reported cases of heart-block in pregnancy, there were Hermann and King's case,[4] who had 6 successful deliveries without complications; Freund's case[4] with 7 normal deliveries; McIllroy and Randall's patient,[4] who went through two gestations, the second of which was a delivery of twins. The interesting factors in our case are that the patient recovered from the pneumonia in spite of the coexisting heart-block, and the pregnancy was not interfered with in any way, the delivery having been uneventful and the condition of the fetus unaffected.

The treatment in this case consisted merely of bed rest and general care during the pneumonic period. This is stressed because we are always likely to attempt to

treat heart-block or any other cardiac case at the mere presence of the condition, which is erroneous. In the absence of symptoms of cardiac insufficiency or of the anginal syndrome, no treatment is necessary regardless of what the cardiac condition might be. In the presence of symptoms, however, proper therapy must be used.

The most common manifestations of the terminal stages in complete heart-block are congestive failure, the anginal syndrome or the Stokes-Adams syndrome. The first requires rest in bed and diuresis. The second may require antispasmodics, sedatives, narcotics, or other medication. The third may respond to adrenalin. Digitalis should not be used in cases of partial heart-block with congestive failure, but it may be used in exceptional cases of complete heart-block with congestive failure, where all traces of vagal influence are gone. Even here it must be used with great caution, and under careful supervision, and its value is questionable.

In my discussion of the prognosis of heart-block, I have, of course, not included the cases of arteriosclerotic origin. These usually have a poor prognosis, but do not enter into our discussion here. We are dealing with block earlier in life before the arteriosclerotic age. It must be realized, however, that even in earlier life the prognosis of the condition is grave where the myocardium is greatly damaged, or where the etiologic factor is continuously operative and is irremovable.

SUMMARY

A case of complete heart-block and pneumonia complicating pregnancy with a successful termination is reported. On the review of the literature no similar case was found, and only 13 cases of complete heart-block alone in pregnancy were reported to date, exclusive of this case. The favorable prognosis and the importance of withholding any therapy in asymptomatic heart-block or any other form of compensated heart disease during pregnancy is stressed.

I am indebted to Dr. Harvey B. Matthews, Director, and Drs. Paul E. Wesenberg and Maurice G. Derbrucke, Attendings, Department of Obstetrics, Coney Island Hospital, for the privilege of observing this case from their department.

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255 Eastern Parkway

Moran, Clarence S.: Fibro-Adenoma of the Breast During Pregnancy and Lactation, Arch. Surg. **31**: 688, 1935.

The writer reports on 27 fibroadenomas of the breast removed during pregnancy and lactation. It was observed that the tumors under these conditions were modified, the changes being similar to those in the surrounding normal breast.

Any lump noted in the breast during pregnancy and lactation should be explored immediately unless the patient is under twenty-five or unless the lesion resembles a mastitis. In the latter case two weeks may be allowed for involution or abscess formation. The patient should be prepared for radical operation when removal of tissue for biopsy is undertaken. It is preferable to remove the tumor during pregnancy when the breast is less vascular. If the tumor is larger than one quadrant of the breast and is of the spindle cell type, it should be treated as a sarcoma.

Hugo Ehrenfest.

LEFT OVARIAN PREGNANCY AND RIGHT TUBAL PREGNANCY

W. K. PUDNEY, M.D., F.A.C.S., MONTCLAIR, N. J.

(From the Obstetric Service of the Mountainside Hospital)

THE primary reason for reporting this case is that of the extreme rarity of a left ovarian pregnancy complicated by a suspected right tubal pregnancy.

Mrs. G. K., twenty-seven-year-old housewife, was admitted to the Hospital on April 7, 1931. A preoperative diagnosis declared it a case of right-sided ectopic pregnancy. An operation performed on April 11, 1931, under spinal anesthesia, included a left oophorectomy, bilateral tubal resection (partial), dilatation and curettage, and a routine appendectomy.

The final diagnosis was left ovarian pregnancy. On April 25, 1931, the patient was discharged, cured.

The patient's chief complaint consisted of vaginal bleeding, lasting over a period of three weeks, and entailing moderate disability. Associated with the vaginal bleeding the patient experienced abdominal pain, nervousness, exhaustion, mental depression, loss in weight, and constipation.

Her husband is living and well, and she has had one previous normal pregnancy. She is an only child whose father and mother are living and well. There has been no history of chronic diseases in the family. In addition to the usual childhood diseases, she had pneumonia and also a fracture of her right leg.

After the onset of her menses at the age of fourteen, her periods were of the four- or five-day type, occurring every twenty-eight days, with a mild amount of dysmenorrhea. Between periods she had some leucorrhea.

The patient's present illness commenced about three weeks before admission to the hospital, when she began having severe pains in the abdomen and some tenderness. The pains were mainly in the lower abdomen, but occasionally she noticed slight pain in the center of her back. She had some nausea and vomiting, but no eructations of gas. The patient was usually somewhat constipated, necessitating an occasional cathartic. Her constipation was not increased during this illness. At the same time as the onset of her pain, she began to menstruate. This bleeding continued until the time of her admission. She passed several small clots. Previous to this her periods were regular and of four or five days' duration. The date of her last regular period is not given. She had no symptoms of shock, but was very nervous, mentally depressed, exhausted, and began to lose weight. She had no shortness of breath, no precordial pain, and no palpitation. There were no other positive symptoms in any of the other organ systems.

Physical examination showed patient to be a well-nourished and well-developed young female, who did not appear acutely ill and had no special complaints at the time of admission. Blood pressure 130/80. Abdomen not distended and no masses felt. Marked degree of deep tenderness in the lower right quadrant. No rigidity, no fluid. Vaginal examination not done. Temperature 98° F., pulse 80, respirations 20 on admission. Patient was kept under observation for four days. During this time there was a moderate amount of vaginal bleeding, and the patient complained of the same pains previously noted. They were not excruciating, however, and she could be kept fairly comfortable with ½ gr. of luminal, t.i.d.

Urine showed clear, acid in reaction, specific gravity 1.020. No albumin, sugar, acetone, or diacetic acid. Few squamous epithelia and leucocytes, no red blood cells or casts. Blood count revealed a hemoglobin of 54 per cent, with 3,510,000

R.B.C., 8,800 W.B.C., 69 per cent polynuclears, 26 per cent lymphocytes, 2 monocytes, and 3 eosinophiles. Color index, 0.77. Sedimentation time, took twenty-five minutes for the level to fall to 24 mm.

On the fifth day the patient was taken to the operating room and a laparotomy performed. Convalescence was entirely uneventful and the patient was discharged on the fifteenth postoperative day.

Macroscopic examination of part of both fallopian tubes and left ovary showed that one tube was 2 by 1½ cm. and the other was 3 by 1½ cm. The walls of both were thickened. The lumen was obliterated in the left tube, and in the right tube the lumen was open and contained spongy material and blood. The other tissue submitted was nothing but blood clots.

Ovary measured 4 by 2 cm. in size, congested and rather roughened and irregular. On cut section, one end was occupied by a membrane and fetus which measured about 2½ by 1½ cm. The rest of the ovary was occupied by blood and spongy material. The wall was exceedingly thin.

Under microscopic examination, the left tube showed hyperplasia of the mucosa and the rest of the wall was infiltrated with fibrous connective tissue and round cells. The blood vessels were thickened. The right tube showed decidual cells and chorionic villi in the lumen and the wall was thickened with an infiltration of fibrous connective tissue and round cells. There were minute hemorrhages throughout the wall.

The sections taken from the bloody and spongy portion of the ovary showed the presence of placental tissue with its chorionic villi and decidual cells.

The final diagnosis was (1) right tubal pregnancy, (2) left chronic salpingitis, and (3) left ovarian pregnancy.

In the present case, with the whole fetal sac clearly imbedded in the ovary and the ovary still easily recognizable, there can be no question as to the diagnosis. But to have the left tube uninvolved and chorionic tissue found in the right tube presents a very interesting complication to this case of left ovarian pregnancy. Certainly the clinical study of these cases has contributed very little or nothing to help in elucidating the etiology of this type of atopical nidation.

PHOTOGRAPHY OF THE CERVIX UTERI*

RALPH P. CREER, AND H. E. KIMBLE, M.D., CHICAGO, ILL.

ALTHOUGH many attempts have been made to photograph the cervix uteri, I have been unable to find any references to the subject in the literature. I have seen a few photographs of this organ, none of which could be termed successful. In most cases drawings have been used to illustrate lesions of the cervix. Proper lighting seems to be the main problem. The usual set-up consists of strong spotlights placed as closely as possible to the camera. It is very difficult to light the entire cervix in this manner, and a further disadvantage is the fact that the light travels practically parallel to the camera lens, thereby producing a very flat picture. The cervix, which is round and has considerable modeling, appears to be all on one flat plane.

Dr. Kimble and I have developed a technic which is new and we believe has several distinct advantages. The essential factor in the success of our work in the photography of the cervix has resulted from the use of a specially designed speculum, of

*Read at a meeting of the Chicago Gynecological Society, May 8, 1936.

a modified, large size, duck billed type, with two special low voltage bulbs mounted in the proximal end of each blade. The inner surfaces of the speculum are of jet black finish, so as to avoid glare from the shiny metal. The bulbs are shaded so as to prevent any light from shining into the lens or from producing undesirable high lights. The lamps are connected to a series of ten flash-light batteries, thereby eliminating the possibility of any serious injury to the patient as a result of electrical shock. The current supply to each bulb is independent of the other, and it is possible to increase or diminish the intensity of each light separately. In this way we are able to control the lighting of our field. For example, in some cases it is best to have the lower light stronger than the upper light or vice versa. In other words, we are able to "model" the cervix with our lights much the same as if the cervix were not an internal organ. With the source of light out of our way, it is a simple matter to set up any camera on a tripod that can be easily and quickly raised or lowered and make the exposure. Most of our pictures have been taken with a 5 by 7 inch clinical camera mounted on an Agfa "Universal" tripod. However, successful pictures have been made with a 3¼ by 4¼ inch Auto Graflex and a 2¼ by 3¼ inch Zeiss Icon with a double extension bellows. It is possible to use a Leica camera for this type of work provided a supplementary lens is employed. Lenses of short focal length are preferred in all types of cavity photography. A comparatively short focal length lens permits one to place the camera nearer to the subject; it reduces the exposure time and gives a greater depth of focus. Our pictures are taken about natural size with an average exposure of two seconds at F:8, using Eastman super-speed portrait film and a 6 inch focal length lens. Supersensitive panchromatic film does not produce the best photographs. If the finer details of the cervix are to be brought out clearly, films that are less sensitive in the red end of the spectrum must be used. This is easily explained when we realize that the colors of the tissues of normal and pathologic cervices are nearly all composed of various shades of red.

High lights on the cervix are quite troublesome. These are due to the mucus which is always present on the surface of the tissue. A powdered mucus digestant called "Alcaroid" may be used to remove this substance, thereby decreasing the intensity of the high lights. A small piece of moist cotton is dipped into the powder and applied directly to the cervix for three to five minutes.

Blurred pictures due to movement of the patient have been few. If the patient holds her breath during the exposure, movement is minimized. We have found the ordinary office surgical examining table with suitable leg rest a very essential part of our equipment. The comfort and ease of the patient must be considered if good photographs are to be produced.

Many conditions of the cervix lend themselves to color photography. Just recently Dr. Kimble and I have made several natural color pictures using the Finlay color process.

The cervix can be photographed best when the lights are placed within the speculum. This method has three distinct advantages. First, the light is not in the way of the camera. Second, the cervix is lighted from a slight angle and as a result modeling is possible. Third, light decreases with the square of the distance it travels; therefore, by placing lights a short distance from the cervix, it is possible to use small low voltage lamps.

A NEW, NONIRRITATING OPAQUE MEDIUM FOR UTEROSALPINGOGRAPHY

Preliminary Report

Paul Titus, M.D., R. E. Tafel, M.D., R. H. McClellan, M.D., and F. C. Messer, B.S., Pittsburgh, Pa.

(From the Department of Obstetrics and Gynecology and the John C. Oliver Memorial Research Laboratory, St. Margaret Memorial Hospital)

THE injection of iodized oil into the uterus and fallopian tubes for the purpose of x-ray visualization, suggested by Cary in 1921, has been a valuable diagnostic procedure. Its limitation or proper restriction solely to patients in whom small tumors are suspected or tubal obstruction has been demonstrated by means of gaseous insufflation (Rubin test) may still be debated by some. Nevertheless, the fact that sharp chemical reactions with irritative salpingitis and the formation of parametritic masses are not infrequently seen following such injections, argues for a limitation of their use. This has suggested, moreover, that the usefulness of this procedure is impaired by its risks, and that a nonirritating medium would be considerably more satisfactory.

The source of the chemical salpingitis and parametritis frequently initiated by these injections seems to lie in the liberation of free iodine from iodized oil.

Mono-iodomethane sulphonate of sodium (skiodan) in watery solution is entirely nonirritating and has been used extensively in urologic work, but its lack of viscosity made it unsuitable for uterosalpingography. Several different combinations with viscid media were devised in an effort to develop such a solution of the same viscosity as iodized oil. Dextrose, starch, glycerin, propylene glycol, and tragacanth were rejected after animal experimentation showed that for various reasons, to be outlined later, they were unsuitable.

A solution containing 40 per cent of mono-iodomethane sulphonate of sodium (skiodan) in acacia 20 per cent finally proved suitable.* Injections in the tubes of rabbits showed no irritative, histologic changes, and its clinical use has followed thus far with entirely satisfactory results. Moreover, the x-ray pictures seem sharper and clearer than with the iodized oil preparations.

A more detailed description of this preparation, its development, the animal experimentations, and its clinical use is to follow this preliminary report at a later date.

*Suggested and developed by Dr. O. W. Barlow of the Research Laboratories, Winthrop Chemical Company.

Department of Practical Problems in Obstetrics and Gynecology

Conducted by William J. Dieckmann, M.D.

THE TREATMENT OF ECLAMPSIA

William J. Dieckmann, B.S., M.D., Chicago, Ill.

(From the Department of Obstetrics and Gynecology, The University of Chicago, and The Chicago Lying-In Hospital)

THE treatment of eclampsia is still unsettled. Some obstetricians advocate medical treatment with a complete disregard of the pregnancy. Some advise the immediate termination of pregnancy, usually by cesarean section, and others advocate a combined medical and obstetric treatment together with individualization of the case. We shall first outline the essential procedures of the various methods of treatment and then describe a combined method which seems to give the best results in many clinics.

Drugs, including the nitrites, croton oil, pilocarpine, etc., and procedures, such as the injection of air into the breasts, nephrotomy, renal decapsulation, dry cupping, hot packs, etc., are used only rarely.

The treatment of eclampsia, in general, has been divided into surgical and medical.

The surgical treatment consists of the immediate termination of the pregnancy by cesarean section, vaginal hysterotomy, or by manual or instrumental dilatation (accouchement forcé) of the cervix, followed by version and extraction. The only large clinic, as far as we know, in which eclampsia is still treated by immediate delivery is the Berlin Frauenklinik, supervised by Stoeckel. No recent figures for their maternal mortality are available, but others who practice immediate delivery have reported a mortality rate as high as 23 per cent, and less experienced physicians may have a mortality rate of 48 per cent, as reported in one city.

The medical treatment may be divided into two large groups, as follows:

Stroganoff or Sedation Method[1]: Large amounts of morphine and chloral hydrate are administered. Any necessary manipulations are performed under chloroform anesthesia. Venesection and early, but not forcible, delivery through the natural passage are advised.

Rotunda Hospital or Elimination Method[2]: Colonic irrigation, purgation, starvation, and the parenteral injection of 1 per cent sodium bicarbonate solution are the essentials of the original treatment. The use of morphine and venesection have been added. Labor may be induced only after three days' treatment.

REVIEW OF THERAPEUTIC PROCEDURES

1. Elimination.—

Colon Lavage: An essential part of the Rotunda Hospital treatment entails the irrigation of the rectum and colon, using 500 c.c. of warm water at a time and continuing the lavage until a satisfactory evacuation of fecal material has been obtained and the water returns clear. This may require from thirty to sixty minutes and may be repeated every six hours if the convulsions continue or if an anuria develops. This appears to be rather drastic therapy when the same result apparently can be achieved with enemas.

Enemas: The usual soapsuds enemas may be given. Two hundred cubic centimeters of a saturated solution (50 per cent) of magnesium sulphate has been used to dehydrate the patient. It is definitely contraindicated in the presence of a severe oliguria.

Catharsis: The Rotunda Hospital treatment prescribes two ounces of castor oil or three ounces of misturae sennae compositum if the patient is conscious If unconscious, the stomach is washed out with warm water and the purgative injected before the tube is withdrawn.

2. Sedation.—

Morphine[3] is given hypodermatically in ¼ to ½ gr. doses. Two hours should elapse between injections and no more than 2 gr. should be given in twenty-four hours. One-eighth to one-fourth grain may be given intravenously if the convulsions cannot be controlled with the usual doses, or if the patient is maniacal. If the respiratory rate drops to 10 per minute, no more morphine should be given and atropine may have to be injected.

Morphine, if given in large amounts to animals, produces a rapid and marked acidosis, due to the decreased elimination of carbon dioxide by the lungs. It also causes a concentration of the blood and a decrease in urine volume.

Chloral hydrate is one of the most essential parts of the Stroganoff treatment. If the patient is conscious, 2.0 gm. (30 gr.) are given in milk by mouth. If unconscious, it is given in 100 c.c. of milk by rectum. In either case, it is repeated every six hours, but the dose is decreased to 1.5 gm. (23 gr.). If the convulsions cannot be controlled, these amounts are increased 25 to 50 per cent.

Chloral hydrate is a powerful cardiac depressant and may cause a drop in the blood pressure. The side actions produced by it show considerable resemblance to those of chloroform.

Chloroform is used freely in the Stroganoff treatment. It is a definite liver poison and is now used in very few clinics.

Ether has been given by inhalation to control the convulsions, or 60 c.c. of ether and 120 c.c. of olive oil or mineral oil may be given by rectum. It causes an increased pulmonary secretion and, therefore, if used should be administered with caution.

Magnesium sulphate has been given intraspinally, intravenously, and intramuscularly. The latter two methods are preferable and are as follows:

Intravenous,[4] 20 c.c. of a 10 per cent solution are injected and repeated every hour until the convulsions are controlled. Occasionally,

the injection of 100 to 200 c.c. of a 2 per cent is more efficacious than the 10 per cent solution, especially in a patient with hypertensive encephalopathy.

Intramuscular, 15 c.c. of a 25 per cent solution are injected deep into the gluteal muscle and 15 c.c. are given after each convulsion until controlled. As much as 200 c.c. has been administered in twenty-four hours.

Magnesium is eliminated chiefly by the kidney. Therefore, if an anuria or even a severe oliguria is present, magnesium is retained in the blood and may reach a concentration at which coma ensues and death may result.

Barbiturates.—Sodium amytal[5] may be given intravenously as a 10 per cent solution. The rate of injection is 1 c.c. per minute. Five to ten cubic centimeters, 0.5 to 1.0 gm. (7½ to 15 gr.) may be necessary to control the convulsions; then 0.2 gm. (3 gr.) is given every four hours either by mouth or rectum.

Luminal sodium or phenobarbital sodium, 0.12 to 0.3 gm. (2 to 5 gr.) can be given subcutaneously or intravenously.

Nembutal or pentobarbital sodium,[6] 0.5 gm. (7½ gr.) may be dissolved in 10 c.c. of sterile water and 4 to 8 c.c. given intravenously at the rate of 1 c.c. per minute; 0.6 to 0.8 gm. (6 to 8 capsules of 1½ gr. each) is given in addition by rectum. Ten or 12 capsules may be given alone by rectum. If convulsions recur or restlessness appears, 3 to 6 capsules may be given and repeated in twelve hours, if necessary.

The barbiturates, if given intravenously to animals, stop convulsions, produce muscular relaxation, induce sleep, and lower the blood pressure. The latter effect is usually only temporary, but it may be so marked and prolonged that an anuria or oliguria results. They produce a slight increase in the carbon dioxide content of the blood and a fall in the pH, that is, a slight and temporary acidosis is produced. A slight blood dilution occurs, but in view of the marked increase in weight and volume of the spleen, the dilution is apparently not a true one but is due to a withdrawal of cells by the spleen. Large amounts of the barbiturates are certainly contraindicated. McGee reports that when amytal was given intravenously in eclamptics, it lowered the blood pressure to such a degree that an anuria was produced. Ephedrine sulphate had to be given to raise the blood pressure to produce a secretion of urine.

3. Venesection.—The withdrawal of 300 to 1,000 c.c. of blood is still practiced in some clinics. The results of treatment indicate that venesection is not essential, providing other procedures can be carried out. Furthermore, it cannot be performed very often; only one venesection may produce an anemia of such a degree that, if there is excessive blood loss during delivery, infection may occur because of lowered tissue resistance or death may result from the anemia. The eclamptic patient is not plethoric. The average hemoglobin is 14.9 gm. per 100 c.c. of blood. This figure, which is high for the pregnant individual, is the result of the blood concentration. After delivery the hemoglobin will drop 10 to 40 per cent.

Irving has substituted plasmapheresis for venesection. One thousand cubic centimeters are drawn into a sterile bottle containing sodium citrate. Under aseptic conditions the cells are separated from the plasma and reinjected into the patient. The loss of hemoglobin

is negligible. He occasionally still uses the procedure. The writer has noted no beneficial results in a small series of patients.

4. Parenteral Fluids.—

Sodium Bicarbonate: Five hundred cubic centimeters of a 1 per cent solution are injected beneath each breast, or intravenously in severe cases, according to the Rotunda Hospital treatment. This solution, as well as normal saline and Ringer's solution are, as a rule, contraindicated in eclampsia because the tissues are usually edematous and, therefore, contain an excess of electrolyte.

Glucose Solution*: Various concentrations are recommended for intravenous injection. Titus and coworkers advise 500 c.c. of a 15 per cent solution, which is injected over a period of thirty minutes and may be repeated two to four times in twenty-four hours. Fay and Arnold give 50 c.c. of a 50 per cent solution every four to six hours. I,[7] as a rule, give 500 to 1,000 c.c. of a 20 per cent solution over a period of thirty to fifty minutes and repeat it every six to eight hours. In certain cases 300 to 800 c.c. of a 30 per cent solution, or 100 to 200 c.c. of a 50 per cent solution are given.

Two hundred cubic centimeters of a 50 per cent solution of sucrose also has been used. Although our experience is limited, it is no more efficacious than glucose and if the anuria persists, it is potentially dangerous.

The proper use of hypertonic solutions of glucose in pregnancy is one of the outstanding accomplishments of modern obstetrics. The improvement in the maternal mortality rate for eclampsia in the past fifteen years must be attributed in great part to parenteral injections of glucose solution.

5. Spinal Puncture.—This procedure has been tried at various periods and again has been recently advocated by Arnold and Fay. They drain the canal every three to six hours, as is necessary.

6. Dehydration.—The convulsions, coma, hyperpyrexia and various other cerebral and visual symptoms are in all probability caused by an abnormal amount of water in the tissues of the brain. As a rule, there is an edema but all of these symptoms and signs can be produced by an abnormal loss of fluid from the brain. Almost all methods of treating eclampsia have resulted in a negative fluid balance. The most recent method to dehydate is the Temple treatment which was described by Arnold and Fay[8] in 1932. They dehydrate their patients by repeated spinal drainage, by magnesium sulphate solution given intravenously and by mouth or rectum, by intravenous hypertonic glucose solution, by venesection and starvation. The fluid balance is regulated so that it is negative. Dehydration was used in the nineties to control the convulsions of eclampsia and uremia but was discontinued. While the present method is a tremendous improvement over the old one, the results are no better than those achieved with other methods. It has been our experience that excessive restriction of fluid and very large doses of magnesium sulphate as a purgative have occasionally seemed to make the toxemic patient worse.

7. Diet.—During the eclamptic attack, nothing should be given by mouth. Complete starvation for at least three days is part of the Rotunda Hospital treatment.

*Solutions in 500 to 1,000 c.c. amounts for parenteral injection are prepared by various concerns and readily available through medical supply houses in almost all large cities.

8. Veratrum Viride.—Very few clinics, as far as we know, still treat eclampsia with this drug. Gillespie,[9] some years ago, described its use as follows: Sixty minims of veratrone are given on admission, and 15 minims every ten minutes until there is sighing respiration, copious vomiting, which should last for at least two hours, and a soft pulse with a rate of 40 to 60 per minute. Anderson states that at the Glasgow Royal Maternity Hospital they give 0.5 c.c. (7½ minims) of veratrone if the systolic blood pressure is over 160. They never repeat the injection because of the possibility of shock developing. This drug is a powerful cardiac depressant. Bailey and Schwarz each stated that when the use of the drug was popular many patients went into vascular collapse or shock after its administration and some deaths were undoubtedly attributable to it.

9. Pregnancy.—It is an incontrovertible fact that the products of conception (placenta and/or fetus) are responsible in some way for the eclampsia, and that the earlier they are removed the better chance the patient has of surviving. Mortality reports, some of which are given in Table I, indicate that surgical treatment, almost without exception, results in an appallingly high death rate. Likewise, if medical treatment is used and no attempt is made to terminate the pregnancy, especially in the severe cases, the mortality rate is also very high. However, the radical surgical method in inexperienced hands gives a mortality rate which is two or three times as great as the radical medical method in the same hands. It is obvious that there is a middle course. Careful observations in many clinics indicate that the medical treatment, together with early but not forcible termination of pregnancy, gives the best results.

Eden and coworkers have stated that the patients with eclampsia could be classified as mild or severe, depending on certain symptoms. They stated that the case was severe if two or more of the following findings were present: Coma, temperature over 103° F., pulse rate over 120, more than 12 convulsions, blood pressure over 200, no edema and the urine solidifies on heating.

Eden classified 706 patients who had been treated by various physicians.

AUTHOR	COUNTRY, STATE OR CITY	YEAR OF REPORT	NUMBER OF ECLAMPTIC PATIENTS	MORTALITY PER CENT		TREATMENT
				MATERNAL	FETAL	
Peterson	U. S. A.—collective	1914	283	25.8		Radical surgical
Davis and Harrar	New York	1926	495	23.7		Radical surgical
Kontsek	Germany	1931	117	18.0	16.0	Radical surgical
Williams	Baltimore, Md.	1912	110	22.8	57.6	Radical surgical
Miller and King	New Orleans, La.		138	38.8		Radical surgical
Zweifel	Germany	1923	394	18.5		Radical surgical
Plass	All—collective	1927	4607	21.7		Radical surgical
Upshaw	Altanta, Ga.	1932	91	5.4	25.9	Combined
Dorsett and Dieckmann	St. Louis, Mo.	1929	186	7.0		Combined
Williams	Baltimore, Md.	1927	165	13.3	56.6	Combined
Miller and King	New Orleans, La.		38	15.8		Combined
Zweifel	Germany	1923	317	8.5		Combined
Plass	All—collective	1927	5976	11.1		Combined

	MATERNAL MORTALITY—%	
	MILD	SEVERE
Natural delivery	4.5	36.9
Assisted delivery	5.6	31.7
Induction of labor	6.6	26.4
Cesarean section	11.3	46.3
Accouchement forcé	18.1	63.1

It is obvious that the mortality rate for the mild cases is markedly increased by any procedure which carries its own mortality. In contrast, the severe cases carry a very high mortality rate and any procedure which hastens delivery without any high inherent mortality of its own increases the patient's chances for recovery. The conclusion is obvious that severe eclampsia is best treated by early delivery.

Many obstetricians have stated that it is difficult, if not impossible, to classify the type of eclampsia early enough to be of value. At the Chicago Lying-In Hospital we classify the severe type by the presence of one or more of the following findings:

1. Coma.
2. Temperature of 102° F. or more.
3. Pulse rate over 120.
4. Respiratory rate over 35.
5. More than 10 convulsions.
6. Cardiovascular impairment (edema of the lungs, persistent cyanosis, low or falling blood pressure, low pulse pressure, etc.).
7. Failure of our treatment to:
   (a) Stop the convulsions or prevent their recurrence.
   (b) Produce a urinary output of at least 700 c.c. per twenty-four hours.
   (c) Prevent the onset or increase in degree of coma.
   (d) Produce a dilution of the blood as indicated by a decrease of at least 10 per cent in hemoglobin, cell volume or serum protein concentration.

With these criteria and the knowledge of what our treatment should accomplish, we can frequently classify the type of case on admission or within six to eight hours. If the case is severe arrangements are made to terminate the pregnancy by the easiest and safest method.

COMBINED METHOD OF TREATMENT (CHICAGO LYING-IN HOSPITAL)

The treatment which is used at the Chicago Lying-In Hospital[10] and which, with perhaps minor changes, is used in many other clinics, may be termed the "combined method" because the essential parts of the various methods have been systematized for certain definite purposes.

GENERAL TREATMENT

The patient is placed in a quiet, cool, darkened room. Constant observation is necessary to prevent injury to the tongue, falling out of bed and aspiration of vomitus or drowning from the occasional excessive pulmonary secretions. A mouth gag (clothes pin, tooth brush) and tracheal catheter should be at hand. A catheter should be kept in the bladder until the patient is definitely improving. The temperature, pulse and respiratory rate, urine volume, and blood pressure should be determined every two hours until the patient is conscious and improving. The period is then lengthened to four hours

and later the intervals are increased still further. The patient's condition as to the number of convulsions, the degree of coma, the quality of the pulse, difficulty in breathing, cyanosis, etc., should be noted.

CONVULSIONS

Since all drugs are toxic in the doses necessary to control the convulsions, we prefer to use several simultaneously. Smaller amounts are, therefore, required and the undesirable effects of each are minimized. A number of hypnotic drugs are mentioned because all are not always available. We prefer magnesium sulphate and luminal sodium. If the case is protracted, chloral hydrate is used.

Morphine.—One-fourth grain is given on admission and repeated at hourly intervals until the convulsions are controlled or the respirations drop to 10 per minute.

Magnesium Sulphate.—Ten cubic centimeters of a 25 per cent or equivalent amounts of a 50 per cent solution are injected and 5 c.c. of the former solution are given after each convulsion or until a total of 30 c.c. has been given.

Luminal Sodium.—Three-tenths gram (5 gr.) is injected subcutaneously and, if necessary, it is repeated in twelve to twenty-four hours.

Chloral Hydrate.—Two grams (30 gr.) are given in 100 c.c. of starch water (one tablespoonful of starch to 100 c.c.) by rectum and repeated as necessary.

ELIMINATION

A soapsuds enema is used and should be repeated until a satisfactory bowel movement has been obtained. If the patient is vomiting the stomach is emptied with a nasal tube but no cathartic is injected. Sodium sulphate (Glauber's salt), 30 to 45 gm., is a safer purgative than magnesium sulphate.

HYPERTENSION

The blood pressure, at least in part, is compensatory. All sedative drugs lower it, but the barbiturates and chloral hydrate are the most efficacious in reducing it or in preventing further increases.

RENAL AND CEREBRAL SYMPTOMS

The oliguria or anuria, coma, fever, tachycardia and cerebral edema are treated with injections of hypertonic glucose solution. Five hundred to 1,000 c.c. of a 20 per cent solution are given intravenously over a period of thirty to fifty minutes and this amount is repeated every six to eight hours, if necessary. The temperature of the solution at the needle point must be 100° F. This can be achieved by immersing at least three feet of the rubber tubing in water at a temperature of 104 to 106° F. Within four hours after the injection the urine volume should equal at least 60 per cent of the volume injected. Sufficient glucose solution is given to insure a urinary output of at least 30 c.c. per hour and should be continued during the postpartum period until the normal diuresis begins. If the 20 per cent concentration does not produce a diuresis, 500 to 800 c.c. of a 30 per cent solution are used. If there is an anasarca or if there are symptoms

of cardiac failure, 300 to 500 c.c. of a 30 per cent, or 100 to 200 c.c. of a 50 per cent solution are given. We have never seen any injurious effects if the glucose solution is properly prepared and administered.

PREGNANCY

While the various procedures outlined above are being carried out, the period of gestation, size of fetus, and irritability of the uterus are determined. No attempt to start labor or terminate the pregnancy should be instituted until the eclampsia is under control, which usually requires six to ten hours.

Antepartum and Intrapartum Eclampsia.—If there is cephalopelvic disproportion, a cesarean section should be performed when the eclampsia is under control. This presupposes that the case is not actually or potentially infected.

Severe Eclampsia—Over 35 Weeks' Gestation: If there is no disproportion and if the cervix is effaced and soft, labor should be induced by rupturing the membranes, care being taken to drain off as much of the amniotic fluid as possible, and, if necessary, inserting a bag. Pituitrin in doses of one or two minims or preferably pitocin may be given subcutaneously every thirty minutes until the interval between contractions is two or three minutes and the duration of each is forty to fifty seconds. But if the cervix is long, firm and closed, a cesarean section should be performed if the environment is suitable.

Severe Eclampsia—Under 35 Weeks' Gestation: The cervix will, as a rule, be uneffaced, firm and closed. In general, labor should be induced as described in the preceding paragraph.

Mild Case—Any Period of Pregnancy: No operative procedure should be carried out. Labor should be induced only if the cervix is soft and partly dilated. If the patient is not delivered, she must be kept under close observation until the pregnancy is terminated, because if the eclampsia recurs it is usually of the severe type and is quite often fatal.

Postpartum Eclampsia.—The treatment is entirely medical.

DIET

If the patient is conscious or as soon as the stomach is emptying itself, as indicated by a failure to aspirate water which has been previously injected, a 10 per cent solution of Karo syrup is injected through the nasal tube at hourly intervals. The initial amount is 50 c.c. and is increased by 50 c.c. amounts up to the patient's tolerance (usually 200 to 300 c.c.). These feedings are continued until the patient is able to take the eclamptic diet which consists of water, fruit juices and fruit. The fluid balance must be watched carefully and kept negative.

MISCELLANEOUS PROCEDURES

The withdrawal of 500 to 1,000 c.c. of blood may be necessary if acute cardiac failure and pulmonary edema develop. Spinal puncture is rarely if ever indicated and then only if there are signs of a markedly increased intracranial pressure. The blood pressure should be watched carefully. Occasionally it drops before delivery and may require treatment. After delivery a 10 to 15 pound weight (sand bag) should be placed on the abdomen and a tight binder applied for eight to twelve hours to prevent vasomotor collapse. If the latter

occurs, ephedrine (¾ gr.) every two to four hours, hypertonic glucose solution and occasionally blood transfusions are necessary. Atropine in doses of $\frac{1}{100}$ gr. should be given if there are many râles. Up to $\frac{1}{30}$ gr. may be given within one hour if pulmonary edema occurs. Oxygen should be administered by nasal catheter if the patient is cyanotic.

ANESTHESIA

Operative procedures can be performed quite often without any additional anesthesia because of the large amounts of narcotics already given. If additional anesthesia is necessary, local infiltration with novocaine solution is preferable.

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Society Transactions

OBSTETRICAL SOCIETY OF PHILADELPHIA

MEETING OF MAY 7, 1936

The following papers were presented:

Ovarian Rupture Causing Intraperitoneal Hemorrhage. Dr. S. Leon Israel (by invitation). (For original article, see page 30.)

A Consideration of Lumbosacral Spina Bifida Occulta With Special Reference to Uterine Prolapse. Dr. George M. Laws. (For original article, see page 126.)

Some Remarks Concerning the Use of Internal Podalic Version in Obstetrics. Dr. George Ulrich.

CHICAGO GYNECOLOGICAL SOCIETY

MEETING OF MAY 8, 1936

The following papers were presented:

Photography of the Cervix Uteri. Dr. Ralph H. Creer and Dr. H. E. Kimble. (For original article, see page 162.)

Vascular-Renal Effects of Posterior Pituitary Extracts in Pregnant Women. Dr. William J. Dieckmann and Dr. Herbert L. Michel. (For original article, see page 131.)

Evipal Soluble Anesthesia in Gynecology. Dr. Herbert L. Schmitz. (For original article, see page 102.)

Clinical Observations on the Effect of 800 K. V. Roentgen Rays in Uterine Carcinomas. Dr. Henry Schmitz. (For original article, see page 74.)

Evaluation of Salpingostomy and Tubal Implantation for the Treatment of Sterility. Dr. J. P. Greenhill. (For original article, see page 39.)

Department of Reviews and Abstracts

CONDUCTED BY HUGO EHRENFEST, M.D.

Selected Abstracts

GYNECOLOGIC OPERATIONS

Jonas, Emil: Simplified Technique of Abdominal Supravaginal Hysterectomy, Illinois M. J. **68**: 347, 1935.

The author lists 6 positions where fibromyomas may be found when the peritoneum is opened. Each position necessitates a slight modification in the technic, which is as follows: one clamp is placed on the insertion of the round ligament into the uterus. A No. 1 chromic catgut suture is placed laterally to the clamp, and the ligament cut between clamp and suture. The process is repeated on the fallopian tube and the ovarian ligament, bilaterally. Each suture is left long and held by a separate forceps. The sutures are now raised so that the two layers of the broad ligament can be separated. The anterior layer on each side is cut downward in the direction of the cervix, keeping close to the uterus. The bladder is pushed away and a transverse incision is made on the anterior layer from one side of the cervix to the other. The uterus is delivered through the abdominal opening by means of traction forceps and the bladder elevated with a narrow retractor. A cut corresponding to that made in the anterior layer is now made in the posterior layer of the broad ligament, and the terminal cut ends are pushed downward, exposing the uterine vessels. These are now ligated as follows: using No. 1 chromic catgut and a cervical needle two mass sutures are taken into the cervical tissue one-half inch apart and one-half inch from the cervix. The long ends of these sutures are tied on the anterior wall of the cervix. Another ligature, carried by an aneurysm needle, is placed between these two sutures. A transverse cut now amputates the cervix. Usual treatment of the stump and peritoneum follows.

EUGENE S. AUER.

Loute, L.: Systematized Ligamentopexy in Conservative Gynecology, Presse méd. **84**: 1628, 1935.

The physical factors responsible for the maintenance of the normal position of the uterus are reviewed, and the mechanism of acquired retrodisplacements of the organ is discussed.

The author presents his modification of the round ligament shortening operation by Doléris, and advocates the method for correction of either existing retrodisplacement or as a routine procedure in any conservative gynecologic operation to prevent future displacements.

Technic: Pfannenstiel incision. The round ligaments are cut laterally at their entrance into the internal inguinal ring and the distal segment is ligated. Each

rectus muscle is perforated with forceps obliquely at the level of the internal ring through the middle inguinal fossa about a centimeter medial to the deep epigastric artery. With forceps the free ends of the round ligaments are drawn through the oblique tract and sutured to each other in front of the recti. Abdominal wall closed in usual manner.

Following advantages are stressed: Simple operative technic based upon anatomic and physiologic principles, with practically no operative risk; good immediate and remote results (checked by pelvic examinations and hysterography); no detrimental effect on fecundity, pregnancy, delivery or postpartum state.

ARNOLD GOLDBERGER.

Thomä, E.: The Alexander-Adams Operation. Results of an Investigation of 200 Operations, Monatschr. f. Geburtsh. u. Gynäk. **103**: 49, 1936.

In a series of 200 Alexander-Adams suspension operations the author reports recurrences in only 1 per cent as far as the anatomic results were concerned. Concerning functional results, the operation was a success in 91 per cent of the cases. Only 2.5 per cent of the patients actually claimed they were not helped by the operation. There was only 1 abdominal hernia in this series. Pregnancy followed in 13.5 per cent of these patients and complications did not occur in a single one during labor.

J. P. GREENHILL.

Sigwart, W.: Ventral Suspension of the Uterus and Its Permanent Results, Monatschr. f. Geburtsh. u. Gynäk. **102**: 286, 1936.

The author claims the following advantages for his operation for ligament suspension of the uterus: There is no danger of ileus. The uterus is placed both in a practical and physiologic position. Other disturbances do not occur and during subsequent pregnancies and labors there are no complications. There are no disturbances as a result of the fixation of the round ligament.

J. P. GREENHILL.

Goulart de Andrade, Claudio: The Treatment of Prolapse of the Uterus by Halban's Operation, Rev. de gynec. e d'Obstet. (Rio de Janeiro) **29**: 631, 1935.

The writer reports in detail two cases of complete prolapse of the uterus operated by a modified Halban's technic which in his belief proves highly satisfactory for this type of case.

F. L. ADAIR AND J. SUAREZ.

Brandt, T.: A Tubo-Uterine Method of Permanent Sterilization, Acta obst. et gynec. Scandinav. **16**: 160, 1936.

In the author's method of producing permanent sterilization in women he first places a ligature about 1 cm. below the uterotubal junction on each fallopian tube. This affixes the tubes to the uterus. He then proceeds to make the usual uterotubal excision and closes the wound in the uterine corner with two Lembert stitches. The raw surface is then completely peritonealized with the round ligament although this part of the operation is not essential. The operation can readily be performed in three minutes, it is bloodless, and the results according to the author are excellent.

J. P. GREENHILL.

Koller: Hydrosalpinx Following Sterilization by Crushing and Ligation of Uterine Tubes, Arch. f. Gynäk. **155:** 185, 1935.

The author describes three instances in which hydrosalpinx resulted from sterilization operations by crushing or ligating the tubes. In one patient both methods were used. He believes that sterilization operations should be preceded by careful temperature, leucocyte and sedimentation time controls to rule out any possibility of existing infection, and that no operation should be performed until all tests are found normal. The sterilization should never be performed until at least eight weeks have elapsed since delivery, abortion, or fever. A longer period should be allowed if pelvic thromboses or pelvic infection has been present.

The method of sterilization should be as simple as possible. All stumps and all tissues with impaired circulation should be extraperitonealized. The author now uses subperitoneal resection of the tubes without ligation, followed by peritonealization. He recommends using only the isthmic portions of the tubes because this will prevent either immediate hydrosalpinx formation or ascending infection with subsequent hydrosalpinx. Any evidence of tubal infection or inflammation at the time of operation requires tubal resection rather than sterilization by any form of tubal ligation.

RALPH A. REIS.

Runge, H.: Disturbances Following the Removal of One Ovary, Monatschr. f. Geburtsh. u. Gynäk. **100:** 233, 1935.

It is ordinarily believed that during the course of an operation, we may safely remove one ovary without concerning ourselves about subsequent disturbances. However, it is the opinion of Runge that trouble arises more frequently than is realized. He instituted a follow-up of 345 women who had only one ovary removed. Of this number 196 were traced. In the majority of instances the original diagnosis which necessitated removal of one ovary was either chronic inflammatory disease or ectopic pregnancy. In order to determine whether the remaining ovary suffered from removal of the other ovary, a study was made of disturbances in menstruation following the operation. Regular menses as before the operation 52 per cent, improved menses 13 per cent, unchanged menstrual periods 4 per cent, more frequent periods 7 per cent, less frequent periods 2 per cent, diminished flow 9 per cent, increased flow 5 per cent, and amenorrhea 3 per cent. Cystic degeneration of the remaining ovary was found in 15.5 per cent of the cases. Whereas in severe instances, ovarian cysts are the result of adhesions around the ovary with prevention of follicle rupture this is by no means true of all cases. Furthermore, not all cases of cystic ovary are associated with menstrual disturbances. Even pregnancy may occur in the presence of a cystic ovary. The practical lesson from this study is that for undisturbed genital function to occur, both ovaries are essential.

J. P. GREENHILL.

Dieulafé, R.: Conservation of the Uterus After Bilateral Oophorectomy and the Question of Uterine Hormones, Rev. franc. de gynéc. et d'obst. **31:** 21, 1936.

The author is of the firm opinion that numerous clinical facts show that conservation of the uterus even after both ovaries are removed is far from illogical because it frequently prevents the appearance of menopausal symptoms which usually follow castration. Histologic and experimental investigations show that the uterus has an internal secretion. Furthermore, the anatomic situation of the uterus helps in maintaining the physiology of the small pelvis. The author be-

lieves that a healthy uterus or one even slightly inflamed should be retained even if a woman has passed her sexual life. The uterus, however, should be fixed in place to prevent retroflexion or descensus.

J. P. GREENHILL.

Lindner, G.: Conservative Treatment or Operation for Chronic Adnexal Disease, Monatschr. f. Geburtsh. u. Gynäk. **102**: 216, 1936.

The author investigated the results of treatment in 611 cases of adnexal disease. He found that the end-results of conservative operations were inferior to those of nonoperative conservative treatment. However, conservative therapy requires a longer time and usually more than one course of treatment must be administered over a period of many weeks. If conservative treatment does not help the patient or if severe pain persists, then a radical operation should be performed regardless of the patient's age and her desire for children.

J. P. GREENHILL.

Baumgart, E.: The Question of Radical Operation for Chronic Adnexal Disease, Monatschr. f. Geburtsh. u. Gynäk. **102**: 149, 1936.

Baumgart is of the opinion that in spite of strenuous efforts with conservative therapy and in spite of repeated conservative operations, many women with chronic adnexal inflammation have recurrences which keep them in ill health for many years. These patients become free of symptoms only when, in spite of their youth, a radical operation is performed. Hence the author advises that if conservative treatment does not help a patient with adnexal disease, and an operation is to be performed, the operation should be a radical one, even when the ovaries are not badly diseased. In these young women the author failed to observe menopausal symptoms after radical operations.

J. P. GREENHILL.

Björkenheim, Edv. A.: A Case of Malignant Tumor of the Ovary of Mesenchymal Origin in a Six-Year-Old Girl, Finska läk.-sällsk. handl. **78**: 49, 1935.

Björkenheim reports a case of malignant tumor of the ovary of mesenchymal origin in a girl six years old. A unilateral oophorectomy was done.

The history presents a child apparently normal at birth who at the age of four years showed enlargement of breasts with pigmentation of areolae. Severe vaginal bleeding had occurred on two occasions. A tumor of the right ovary about the size of a baby's head was removed at operation. A very detailed report of the microscopic studies follows, together with a review of the statistics, the incidence of primary sarcoma of the ovary being placed at 1.6 per cent to 7.5 per cent by the various authors.

A follow-up two years after operation found the patient well and attending school.

E. C. ANDREASSEN.

Kanter, A. F.: Congenital Absence of the Vagina, Am. J. Surg. **30**: 314, 1935.

The author describes a simplified operation for making an artificial vagina. A small transverse incision is made across the hymen and by blunt dissection the bladder is separated from the rectum. This cavity is then packed. The cavity is dilated, douched and repacked at regular intervals. Within two to three months this cavity will be completely lined with epithelium, the origin of which probably is the hymen.

J. THORNWELL WITHERSPOON.

Jayle, F.: Esthetics in Laparotomies, Compt. rend. Soc. franç. de gynéc. 5: 269, 1935.

The ideal for a surgeon is to leave behind an invisible signature of his surgical performance. In most instances where a median abdominal incision is employed, about two-thirds of the incision is later hidden by the pubic hair, provided there is an abundant growth of hair. However, Jayle makes a plea for the Pfannenstiel transverse abdominal incision because it is the most esthetic of all.

J. P. GREENHILL.

Mahoney, Louis E.: Prevention of Gas Pains, Am. J. Surg. 32: 272, 1936.

Gas pains are the most distressing postoperative complication. Proper preparation of patient and extremely gentle operative manipulations are very important.

Ordinary postoperative treatment and usual dietary regime predispose to gas formation. Hospital liquid diet is semistarvation and causes proliferation of putrefactive and gas-forming bacteria. Liquid diet is to be avoided and water and solid food given at once. Mineral oil is prescribed and enemas are avoided.

The results of such technic are good appetite, no gas pains, bowel movement on the third day, very little loss of weight, and earlier return to work.

J. THORNWELL WITHERSPOON.

Ulrich, B.: Emboli Occurring After Operations Performed Through the Vaginal Route, Compt. rend. Soc. franç. de gynéc. 6: 120, 1936.

Postoperative embolism remains as one of the most disagreeable problems for the gynecologic surgeon. However, the author points out that the risk of embolism after operations through the vagina is extremely small. Gynecologists agree that 75 per cent of all postoperative emboli occur after operations for uterine fibroids, and in most instances without preliminary phlegmasia alba dolens. The only instance of embolism after a vaginal operation, a hysterectomy, was reported by Fournier. One of the most important reasons for the infrequency of emboli after vaginal operations is the lack of operative shock, though shock not infrequently follows abdominal operations and is due to a number of causes. Among them are long duration of the operation, long inhalation anesthesia, Trendelenburg position, and extensive and frequent brusque instrumental and digital manipulations in the abdominal cavity. On the other hand, vaginal operations may be performed very quickly without a general anesthetic and with a minimum of manipulation. Furthermore, there is far less risk of infection with a vaginal operation.

J. P. GREENHILL.

Hristu, C.: Vaccino-Therapy and Avoidance of Drainage, Bull. Soc. d'obst. et de gynéc. 25: 43, 1936.

During the past seven years the author has not resorted to drainage. He builds up the patient's resistance by vaccinotherapy. He vaccinates his patient for a month before the operation. At the time of laparotomy he removes the appendix prophylactically. He is particularly careful that all bleeding is checked and routinely gives vaccines after operation. In 1935 he reported a series of 500 successful appendectomies without drainage.

J. P. GREENHILL.

Items

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HOENIG, EDWARD
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KNIPE, W. H. W.
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VON GRAFF, ERWIN
WARD, G. G.
WARD, WILBUR
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WEISS, JOSEPH B.
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HARRIS, L. J.
HENDRY, W. B.
SCOTT, W. A.
VAN WYCK, H. B.

Syria
Beirut
DORMAN, H. G.

Total..... 611

American Board of Obstetrics and Gynecology

The written examination for Group B applicants will be held in the various cities throughout the United States and Canada on Saturday, March 6, 1937, at 2:00 P.M. Practical oral, and clinical examinations for Group A and B applicants will be held at Atlantic City, N. J., on June 7 and 8, 1937.

Applications must be received at least sixty days prior to the examination dates. Secretary: Dr. Paul Titus, 1015 Highland Building, Pittsburgh (6), Pa.